NEWSPAPER

Bell Lags Independents in Modems

The Consumer Communications Reform Act of 1976, now pending before Congress, seeks to effectively eliminate competition within the telephone industry. One premise of the proposed legislation is that competition in communications has been detrimental.

This article is the first of two which examine the area of data communications equipment and the major product contributions made by independent competitors.

By Ronald A. Frank
Of the CW Staff

Most of the major innovations in data communications modems and associated equipment have been pioneered by independent non-carrier vendors. Many of these innovations were later duplicated to some degree by the Bell System and its operating companies, although some features still are excluded by Bell, apparently for marketing reasons.

These findings are based on an examination of the dates associated with major data communications equipment innovations garnered from *Computerworld* files and verified by industry sources.

The major innovations have occurred in the high-speed data transmission areas which include 4,800- and 9,600 bit/sec. Many of the early suppliers of modems developed their original equipment for military applications and then began to tailor these data sets for commercial use.

In 1967, the Data Communications Division of Milgo (later called International Communications Corp. [ICC]) introduced a 4,800 bit/sec modem which included a manual equalization capability. This unit was believed to be the first to incorporate an equalizer as part of the modem; it is regarded as the device which initiated the high-speed private-line modem market.

Three years later, American Data Systems introduced a 4,800 bit/sec modem with automatic equalization and Datamax announced a similar

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DP Seen Helping In Energy Crisis

By Toni Wiseman
Of the CW Staff

LOS ANGELES – The technological resources of the electronics industry can provide crucial help for America's energy crisis as it has in the past for the "missile gap" and the "space race," according to the president of TRW, Inc.

CW At Wescon

In his keynote address at the Western Electronic Show and Convention (Wescon) here last week, Dr. Ruben F. Mettler discussed the issues and opportunities relating energy and electronics.

The electronics industry is currently manufacturing low-cost synthetic intelligence, for example, which is finding extensive and increasing application wherever energy is consumed, Mettler said.

"Today's LSI circuits and microprocessors are really a form of synthetic, mass-produced intelligence," he said. "Right now, American electronics companies are

(Continued on Page 7)

Numerous Outages in FAA System Putting Aircraft in Danger?

By Ann Dooley
Of the CW Staff

INDIANAPOLIS – Air controllers at the Indianapolis Air Traffic Control Center here have charged they were out of touch with aircraft in flight at least 126 times in a recent 40-day period because the Federal Aviation Administration's (FAA) computerized air traffic system failed.

"We have no idea why the system is gone or when it's going to come back. When you're playing with planes at 500 or 600 miles an hour, it can be dangerous," Dave Morton, an air traffic controller, said.

Since 1974, when the radar data processing (RDP), or narrow-band radar, was implemented at the 20 air-route traffic centers which comprise the nation's air tracking control operation, momentary interrupts or outages have occurred, leaving the system virtually nonfunctioning.

At those moments, controllers have no radar contact with aircraft and must immediately decide whether to wait for the system to come back up or to switch to the noncomputerized and less informational backup system. Such a decision could be critical depending on the number and proximity of planes in an area.

While the time to switch to the backup method is short, controllers have complained it is difficult for them to adjust back and forth to the different systems.

After originally denying reports of the number of failures, FAA officials admitted to Rep. David Evans (D-Ind.) that the Indianapolis center had 97 outages of less than a minute and 29 blanks of more than a minute from June 1 to July 10 and said the reported failures in the system constitute "real and valid cause for high-level concern."

Controllers said they believe the number of outages to be closer to 20 to 30 a week, however.

The outages can occur for a number of reasons, some of which can be inefficient programming or insufficient software; the controllers have complained they are the ones left to correct the mistakes.

"You get so used to the presentation of the data, you get too dependent on the

(Continued on Page 4)

Programmers: 'Wrong on Tasks'

By Don Leavitt
Of the CW Staff

LONDON Programming is still "the unwanted and unrecognized profession without sound foundations," according to Alex d'Agapeyeff, who told a plenary session of the 1976 European Computing Congress (Eurocomp) here last week that "most of the time we have been doing the

CW At Eurocomp

wrong task on the wrong equipment in the wrong way."

Later, the chairman of Computer Analysts and Programmers, a UK software house, and ex-president of the British Computer Society added however that the situation can change only it programmers turn away from the ways they have been working and start to design, build and use flexible, reusable libraries of logical components.

Prof. Brian Randell of the University of Newcastle agreed in general, but noted that while d'Agapeyeff was describing a new form of "bricks and mortar" to build systems, "the fact is that we don't even know what bricks we should be using."

Another panelist, Phil Kiviat, technical director of the U.S. Federal Computer Performance Evaluation and Simulation Center (Fedsim) argued that programming isn't really the principal problem in DP today.

There is, Kiviat said, the far more fundamental question of what is suitable for computerization. Programming "is only a tactical concern," he commented.

During his talk, d'Agapeyeff pointed to four reasons for what he believes is the poor state of affairs in programming. First, he said, programming isn't really professional; there is no widely accepted definition of the skills or training required, and there is no real building on prior experience.

Traditional professions work from precedents – "or, put another way, they stand on the shoulders of those who went before" while "we stand on their toes."

Beyond that, "we listen to quack

(Continued on Page 2)

Users Seem Willing to 'Digest' IBM Price Hikes

By Molly Upton
Of the CW Staff

While the Computer Lessors Association (CLA) intends to formulate a plan to protest IBM's latest price hike on maintenance as a "discriminatory action," users seem to be willing to "digest it as well as possible."

The price hikes, which become effective on Nov. 16, apply to purchased 360s, the lower end 370s through the 125s and assorted peripherals, but not to similar gear under IBM's Monthly Availability Charge (MAC) plan [CW, Aug 23].

The CLA will discuss courses of action during its annual meeting on Oct. 12 in Montreal, according to James Benton, its executive director.

The association will probably talk with the Justice Department and "might have to take matters into our own hands. We can't live with these kinds of increases," Benton said.

"I really think the whole purchase DP community should rebel," he added.

Thomas McArdle, president of both the CLA and National Computer Rental Ltd., said "I think there's no question that it's an attack on the leasing industry."

He sees IBM as "basically using maintenance as a ploy over a period of time to force obsolescence of equipment because of very high maintenance costs.

"It seems it's discriminating against machines that have been around for a while," he said, adding "this is about the fourth increase in four years, averaging 15% each time."

For instance, maintenance charges for a 1403 printer in 1972 were $177/mo compared with $270/mo currently. If increases continue at the same rate, the 1980 fee will be $470/mo, he observed.

In the past, IBM has increased its rental prices as well to reflect the maintenance hikes, but this time the increase was applied to purchased machines only, he said.

"If IBM increased MAC a proportionate amount . . . then it hangs together, but there's no way it hangs together now," Benton added.

Most lessors' equipment has been serviced by IBM since it was purchased and has received identical service to that owned by IBM, so they had difficulty coming up with a rationale other than the move is "discriminatory."

When asked why IBM raised the maintenance charges for purchased gear and not for similar equipment under MAC, a spokesman said "the direct cost of maintenance is only one of many factors which must be considered in arriving at a

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CLA to Protest 'Discriminatory' IBM Price Hikes, But Users Express Willingness to 'Digest' Them

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lease or rental price."

Benton pointed out a similar price increase has not been announced in Canada, attributing this to Canada's anti-inflationary board that reviews companies' justifications for price increases.

Although most lessors are passing the increases on to the users, they are upset because the price hikes diminish the savings the users realize by obtaining their equipment from third-party leasing firms.

Also, "the higher the maintenance goes, the more difficult it becomes to remarket that equipment," McArdle noted.

An IBM spokesman, however, said IBM Canada had not asked the board for an increase.

Reactions of users contacted by *Computerworld* ranged from those who were upset and looking at alternatives to those who were philosophically accepting the increase. Some spoke highly of IBM maintenance and felt it was worth the increased price.

Wayne McCollum, DP manager for Riceland Foods in Stuttgart, Ariz., has a 360/30, 360/50 and IBM peripherals.

Riceland, which is "52 miles in the country from nothing," will probably stay with IBM simply because it receives "super service. We demand it and we pay for it," he said.

The firm serves 27 food cooperatives and operates a 310K real-time system on which it is very dependent, he said.

"I don't think we can back off from our maintenance responsibilities," he added.

Harvey Albert, DP manager for Genuine Parts Co.'s Eastern Division, said he's "not too happy." The move will increase his maintenance bills by about $200/mo or 15%.

"I was under the impression there would be reduction on some items, but I haven't found any," he remarked.

Genuine is exploring independent maintenance, he said. "Overall, the general feeling is we're very, very unhappy" with the price hike.

The auto parts distributor uses IBM maintenance for its third-party 360/40 and everything except add-on memory from Computer Investors Group and its disk drives, which are maintained by Sorbus, Inc.

The increase "is just like everything else, it's another overhead that has to be passed on to the customer," Albert said.

Genuine has seven other similar locations, so the price rise means an increased bill of $1,600/mo for the entire firm," he said.

Somewhat Nonplussed

But Ray Allen, vice-president of Blue Chip Stamps in Commerce, Calif., was somewhat nonplussed by the hike.

Maintenance rates have gone up not only on IBM equipment, but on other gear as well, "so I guess I'm not too upset about it," he said. They all seem to be rising by the same percentages, Allen added.

He rejected obtaining other maintenance for his third-party 360/30 with IBM disk and tape: "Even though people complain about IBM service, it's probably still the best in the business.

When you have a mixed selection like we do, you can tell who's good and who isn't," he added.

Another fan of IBM service is Robert Doherty, American Credit Corp.'s computer operations supervisor. He "doesn't particularly like the increases," but there's "nothing you can do about it."

The increases will mean a hike of about 15% in the maintenance bill for its all-IBM shop, which includes a 360/50 with 512K and three banks of 2314 disks.

Despite the cost, however, the firm isn't looking to independents. "We're well satisfied with the maintenance agreements and the results we get from IBM and our equipment. We'll try to digest it as much as we can," Doherty said.

Ernest Loyer, director of lingerie manufacturer Stardust, Inc., was ecstatic his leased 360/30 is not affected since it is serviced by Sorbus under a long-term contract with a set price.

Programmers Hit for Doing 'Wrong Tasks With Wrong Tools'

(Continued from Page 1)

authorities," he said before describing a study group on which he briefly served whose task was to select a real-time language for government use.

None of the others in the group had any experience in programming, no evidence from technicians was solicited or accepted "and even my questions were disregarded so they chose Coral 66 [a 10-year-old language] as the official language."

In a more serious vein, but without dwelling on the subject, d'Agapeyeff noted the lack of computer expertise in the Data Protection Committee recently named by England's Home Secretary [CW, Aug. 9].

The attitude of the lay computer user – who sees the programmer as an unwanted middleman – is the third reason for the scorn often heaped on programmers, according to d'Agapeyeff. These users often see programs as meeting the programmer's needs and not really those of the user at all, except almost incidentally.

"We must catch the imagination of the users so they can grasp what it's all about," he said before adding, "We don't know much about programming ourselves."

Even the well-publicized conference sponsored by the North Atlantic Treaty Organization (Nato) in 1968 hasn't had much impact, d'Agapeyeff said. While the idea of software engineering, first given a name there, has "some merit," programmers "have generally failed to grasp the true significance of data base," another subject of that same conference.

The fourth reason for programming's present situation is that the current approach to application specifications "is all wrong," he went on, noting the demand for "fixed and unreadable" definitions is often impossible for the user to provide with any real sense of what benefits he may gain from them.

Instead, he suggested, "we should work from some sort of fundamental assumptions" that would provide outside limits for what could be done, inside of which the user could change his mind without penalty or embarrassment.

That sort of approach, however, can only become reality with the use of binding techniques simpler than the present compilers and with adequate libraries of precisely defined logic functions, he said.

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Also Links 3/15 Users With 3600

IBM Adds Eight Faster Printing Models of System 32

By Esther Surden
Of the CW Staff

ATLANTA – The introduction of eight faster printing models of the System 32 highlighted a passel of enhancements for General Systems Division products announced by IBM last week.

IBM also introduced magnetic ink character recognition (Micr) capability for the System 32, Industry Application Packages (IAP) for distributors, lumber dealers and the food industry and an attachment to link the 3600 Finance Communications System to the IBM 3/15.

The addition of faster printers to existing amounts of disk storage comprises the eight models of the System 32 announced. Four of the models are configured with a 285 line/min printer which IBM said doubles the 32's previous line printing capacity; a bidirectional 120 char./sec printer on the remaining models is 40 char./sec faster than the character printer on previous 32 models, the company said.

The firm increased the system's printing capacity to cope with the printing requirements of certain popular applications which "exceeded our offerings at the present time," an IBM spokesman explained.

Present System 32 users can upgrade their units with the printers, he added. For example, a user with a System 32 Model A-24 with an 80 char./sec printer and 13.7M bytes of disk could upgrade to the 120 char./sec printer and the same amount of disk for $1,200.

A Model B-34 user with 13.7M bytes of disk and 155 line/min printer could upgrade to the 285 line/min printer for $8,950, he said.

The eight System 32 models, which will be available next May, range in price from $34,230 for 3.2M bytes of disk and a 120 char./sec printer to $50,410 for a 285 line/min printer and 13.7M bytes of disk.

Micr Capability

The Model 1255 magnetic character reader now operates with the System 32, IBM said. The reader, formerly available only for the 3, 360 and 370 systems, allows small banks and branches to read and sort Micr-encoded documents at speeds of 500- to 750 document/min depending on which model is chosen, the company said.

The 1255 attachment to the 32, available next May, costs $8,775 or $245/mo; the reader itself costs $35,460 or $904/mo for a six-stacker model and $55,260 or $1,450/mo for a 12-stacker model.

The attachment linking the 3/15 to the 3600 Finance Communication System gives 3/15 banking users a capability previously available only to 360/370 users, the spokesman noted.

The family of on-line terminal devices for banks and thrift institutions includes a controller, passbook printers and automatic teller machines.

The 3600 attachment will be available in the second quarter of 1977; no charge will be made for the attachment itself, IBM said.

The IAPs for distributor management, lumber dealers and food distributors consist of four modules each. The programs were designed to help users perform billing, inventory control, accounts receivable and sales analysis.

The IAPs can operate with the recently announced financial applications programs for distributors that consist of accounts payable, general ledger and payroll programs, IBM said.

The distributor IAPs will be available next month and the food and lumber programs will be available in December. The billing module costs $715 initially and $32/mo thereafter as a license fee; the inventory control module costs $625 and $28/mo; the accounts receivable module has an initial charge of $495 with a monthly fee of $22; and the sales analysis program costs $625 and $28/mo.

DP/Graphics System Needed for Business

By a CW Staff Writer

LOS ANGELES – Combining alphanumeric and graphic information will permit businessmen to intelligently deal with the ever-increasing data flow which is the necessary part of the decision-making process, according to Dr. Erik Albarda of Arthur D. Little, Inc.

The development of a business graphics system that enables visualization of data for use by the business community is the challenge which faces the industry today, he told a session at last week's Western Electronic Show and Convention (Wescon) here.

While more than 70,000 output devices are used by DP installations worldwide, only 5% are capable of displaying information graphically, Albarda noted.

"Most of these devices are designed for highly specialized applications. Few, if any, are designed primarily for business applications," he said.

Currently there is no available system, hardware or software, that meets the needs of the business community, he stated.

Visualization of data bases and processed results poses an attractive alternative to the commonly produced long lists of printouts with numbers, he asserted.

Albarda outlined nine features a business graphics system should include: ease of operation, compactness, immediacy, patterns and trends, comprehensiveness, zooming, ratio analysis and socio-economic indicators.

Such a system should be as easy to operate as a copier, he said, adding there are elements of business graphics systems available in today's technology, but they are programmers' tools.

Albarda suggested an effective feature of a business graphics system would be the ability to display large amounts of data in the form of a thematic data map which would permit retention of both an attention-focusing capability or a structural-relational capability.

The LIBRARIAN® and MetaCOBOL® from ADR Boost Efficiency at Computer Power, Inc.

Computer Power, Inc., Jacksonville, Florida, provides complete data processing services for a number of banks, mortgage bankers and saving and loans whose mortgage portfolios have over 1,250,000 mortgage loans valued at over 24 billion dollars.

Over 8,400 program modules are now used to provide client services — modules which require storage space equivalent to 2.7 million card images.

Until The LIBRARIAN was installed, program storage and management was an expensive and time consuming problem

According to Technical Support Manager Roy Flieger, "Before we installed The LIBRARIAN, we stored everything on 17 IBM model 2314 disk packs. That meant we had 17 different source statement libraries. We were making 1000 pack changes a month and we were spending over 50 hours of computer time each month reorganizing files."

"Program standardization was a problem too. Programmers would make changes to one pack and not duplicate the changes on the other packs."

The LIBRARIAN enabled Computer Power, Inc., to cut disk storage by 94%.

After The LIBRARIAN was installed 2 years ago the entire source statement library was immediately compressed with the result that Computer Power, Inc., using the IBM 3330 disk system, now stores all of its 8400 program modules on a single disk, constantly on-line. The benefits were far greater than just the savings in disk use, however. Time required for file reallocation was virtually eliminated. Elimination of disk shutdowns and disk changes added another 50 hours a month of usable computer time. And standardization rapidly improved because common program changes no longer had to be duplicated on many different disks.

"We really have file backup now. And that's tremendous."

Roy Flieger remembers, "When we had 17 packs our backup and savings procedures were extremely time consuming. Now, with The LIBRARIAN and only one disk pack, we are able to save everything every single day in just 20 minutes."

ADR's MetaCOBOL is doing more than just conversion.

Computer Power, Inc., is in the final phases of conversion of more than 6000 program modules from DOS to OS/ANS. According to Roy Flieger, "We're running through MetaCOBOL and coming out with state-of-the-art programs, OS/ANS, single entry, single exit with I/O completely changed. All the programs we have converted so far have executed perfectly the first time."

Programs are being standardized as they go through MetaCOBOL.

"Everything coming out is looking alike. MetaCOBOL is picking up errors in violation of COBOL specifications that the compilers would let go through. As a result, our programs are really coming out clean," he continued.

"As far as I know, there is no alternative to MetaCOBOL."

"Any other system would have required handmade changes involving a staggering amount of time," Roy Flieger added.

ADR software products are an integral part of over 5,000 installations worldwide. Each ADR product is not just a program, but a complete package with full documentation and on-site support. ADR is the only software company with 50 branch offices and representatives in 28 countries – each staffed with ADR-trained technicians.

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Bell System History Shows Lag in Modem Innovations

(Continued from Page 1)

device with forward error correction. Both features simplified data transmission for users, but were not offered by the telephone company.

During this period the Bell System had a multipurpose modem known as the 203 data set which transmitted at speeds up to 7,200 bit/sec. Its transmission scheme, however, was considered less reliable than those of the independent suppliers and automatic equalization was not available on this unit until 1971.

It was not until 1972, or five years after the first independent modem, that Bell delivered its 208A data set, which was considered a direct competitor for the earlier independent modems.

In 1970 Codex Corp. had a 4,800 bit/sec modem that was the first to include a built-in multiplexer, the first to have customer-operated diagnostics to check line quality and the first to have a setup time less than 1 sec.

The setup time was important because computer front ends (mainly the 270X from IBM) timed out in 3.5 sec. If the modem did not get below this higher number, the entire computer connection would be terminated and it would have to be manually reestablished by an operator.

While all early independent modems offered multiplexing, Bell did not provide this capability before 1974, when the 209 data set was first delivered. This was four years after the first independent modem with a built-in multiplexer was installed. When a user is able to multiplex data transmission streams, there is usually a savings in line and/or equipment costs.

First 9,600 Unit

In 1967, Codex Corp. installed a 9,600 bit/sec private-line modem with automatic adaptive equalization and 3.5 sec setup time. This unit was the first to let users transmit data at this higher speed.

Originally priced at $23,500, this modem was within the reach of only the larger sophisticated users such as airlines, who were operating computerized reservation systems.

Bell did not have a 9,600 bit/sec data set until 1974 – seven years after the Codex modem – when it announced the 209.

In 1971, Codex introduced a series of modems operating at 4,800-, 7,200- and 9,600 bit/sec. These devices were the first to offer dial backup capability in the event a private line failed.

Bell did not offer dial backup, and its users were required to have a second set of modems if they wanted to duplicate these features. The price of the Codex 9,600 bit/sec modem was $11,500, less than half the cost of the original Codex modem.

Industry experts generally regard ICC as having set the pace in 4,800 bit/sec modems while Codex pioneered in the 9,600 bit/sec area. The transmission schemes of each independent supplier were adopted by international organizations as certified standards and the Bell 208 and 209 were patterned after each company's methods.

Dial-Up Modems

After developing higher speed modems on private lines, independent suppliers applied the same devices to dial-up facilities. Although private lines could be conditioned to make them more suited for data transmission, this was not possible on a dial-up connection because the circuit path was randomly established with each call. In 1974, Intertel, Inc. introduced a 9,600 bit/sec modem that operates without conditioning on private lines.

Despite these limitations, dial-up modems became commonplace at both 4,800- and 9,600 bit/sec. Bell has a dial-up version of its 208 data set for 4,800 bit/sec users, but there is no dial-up unit for operation at 9,600 bit/sec. Several independent suppliers have such modems, however.

In many cases independent suppliers have tended to combine multiple features in transmission devices. In particular, operator-initiated test and diagnostics allow the user to test both the modem and the line operation. Most features such as these originated with independent suppliers and were later duplicated to a lesser extent by the Bell System.

Advanced circuit technologies such as MOS and LSI were introduced by the independent suppliers and later offered by the telephone companies. These improvements tended to reduce the costs of modems and were met by lowered prices for Bell data sets.

Many of the companies that provided modems and pioneered innovations are no longer in business. One consultant has attributed this to the fact that small independent firms cannot compete against AT&T and its ability to drop prices.

It is estimated that there are about 40 firms which supply modems of all types in competition with the telephone companies. Of these, most have a modem product line as part of a much broader range of equipment.

Only about 15 of these independent vendors concentrate on modems as their primary product, and each typically specializes in one segment of the total modem market.

Despite the relatively few firms matched against the significant resources and competition of the Bell System, the independent vendors have set the standards for data communications equipment with the telephone companies reacting later.

FAA Admits 126 RDP Outages

(Continued from Page 1)

machinery and then it's taken away from you so quickly and with no warning. It's good to modernize, but we just can't depend on this system anymore," Morton said.

Many controllers feel the system has actually increased their workload from a purely mechanical standpoint. Before the RDP system became operational, two people watched plane routes on a screen; now there is only one person to do the same job, because the second person is working on the computer, and that creates more strain on that one person, the controllers claimed.

While the entire national network has had outage problems, one of the most potentially dangerous situations occurred here at the Indianapolis center last June when lightning struck the system and the entire power supply went out.

In that instance, even the backup system was unable to work and controllers could only make contact with aircraft by radio.

Controllers had to manually hand off aircraft to other centers during the blackout, which lasted for 45 minutes, according to William Hirchert, deputy chief of the Indianapolis Air Traffic Control Center.

"It's the nature of our business; there is no waiting, you just have to take action and the controllers did an excellent job," he said.

In response to the failure, Evans began an investigation and he and FAA officials will review the center next month to ensure corrective changes have been implemented.

Critics of the RDP system have charged there has never been sufficient testing [CW, May 7, 1975]. They believe the system was put into use before the FAA knew enough about the problems that would occur in such a large and complex system.

The FAA claimed that adequate testing did occur and that the system was certified before it became operational. The Airways Facility, the group which certified the system, is part of the FAA, however.

Since the ultimate decision making is up to the controllers, Morton feels they should have more training with the computer itself.

"We were supposed to get 34 class hours and six hands-on hours and I ended up with 18 class and one and a quarter hours of hands-on training," he said. "And after that we're supposed to sit down in front of a monstrosity that has 128 buttons and can do probably 500 different functions and make these emergency decisions."

While the FAA said the system is continually being refined, controllers are unhappy that the outages continue to occur.

The narrow-band system follows the location of an aircraft along its course and also indicates the aircraft's identification, altitude and speed.

The RDP system consists of the central computer complex, composed of an IBM 9020 system, and channel display systems developed by Raytheon Corp.

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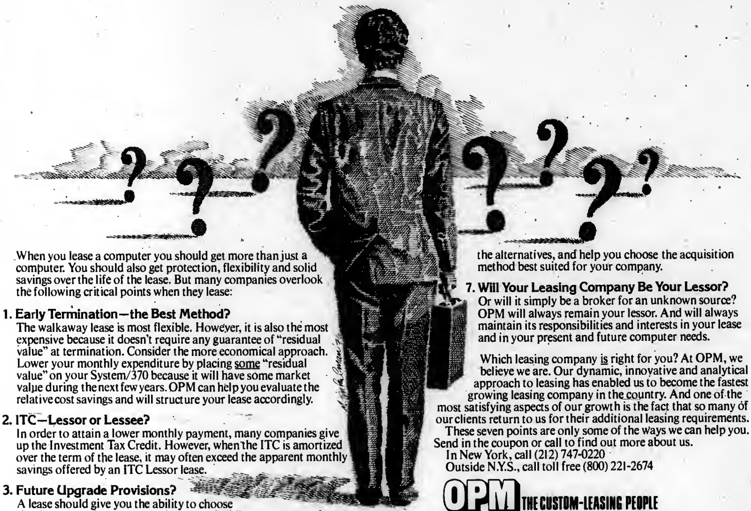
S/370 Computer Leasing: 7 Ways to Avoid Costly Mistakes



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CW 2

Attendees at Wescon Told

Industry Can Provide Important Help in Energy Crisis

(Continued from Page 1)

turning out synthetic intelligence at an astonishing rate.

"Electronic devices are bringing added intelligence, and hence efficiency, to the combustion process in the engines of automobiles," he added.

"They help monitor and control equipment at the refineries which produce oil and even make the oil exploration process more effective by analyzing data from oil wells.

"Increasingly, electronics intelligence is helping people make the use of energy in industrial plants more effective, and in the future it will probably do so in individual homes as well," Mettler said.

Structured to Help

The electronics industry is well structured to help America with the energy crisis, Mettler reasserted. It is large, with $50 billion in sales expected this year; it is a fountain of advanced technology; and it has a record of being able to reduce prices to expand the application of its products, such as semiconductor devices, he said.

Investments in electronics are relatively small and development times relatively short compared to those for processes such as coal gasification and liqulfication, he said, adding that as energy prices rise, economically justifiable electronic applications related to energy will increase in size, offering the industry new markets for its products and services.

Market In Automotives

Automotive electronics will be a growing market, he noted, estimating that market will grow at a 40% annual rate and reach approximately $1 billion by 1985.

General Motors, for example, has announced it will use a microprocessor in its electronic spark-timing system; Chrysler plans to use a pair of microprocessors to accomplish efficient combustion of lean air-to-fuel mixtures, he said.

"This lean-burn system requires seven inputs of data on engine conditions, and the data is used by computers to determine the exact instant at which individual spark plugs should be fired," Mettler explained.

In addition to bringing electronic intelligence to the combustion process, the industry can also replace unnecessary or wasteful transportation with electronic communications systems, Mettler said.

Wescon coverage continues on Pages 35, 38 and 41.

Today, thanks to telecommunications systems, an increasing amount of information travels electronically, he said, noting that scientists no longer have to travel to computers as computers are being linked to one another and to people.

In the energy field itself, electronics are also making inroads, he said. In Texas, there is a computer-to-computer network which processes raw logging data from oil wells.

$5 Billion From Oil Industry

Minicomputers in the field process data from nearby wells, then transmit the processed data to a mainframe which interprets it and sends the results back to the field computers. These then print out reports for the explorers, he explained.

"This year the petroleum industry will spend close to $5 billion on the automation of oil production; a healthy portion of this will go toward electronic and electro-mechanical controls," Mettler said.

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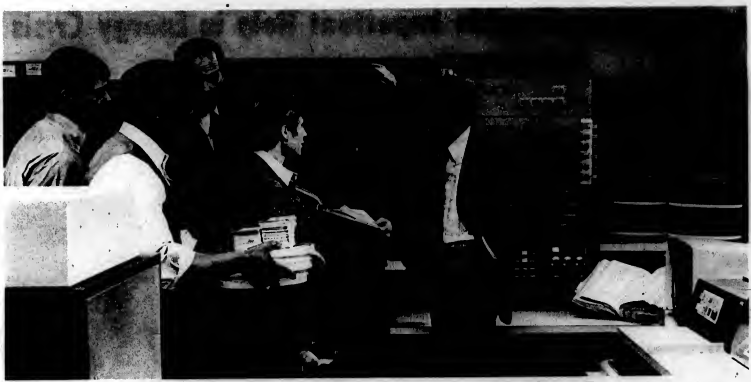

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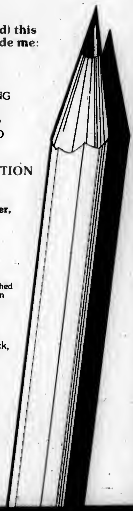

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Price, Features Other Factors

Simplicity Seen Key to Bringing DP 'To the Millions'

By Edith Holmes
Of the CW Staff

WASHINGTON, D.C. – "Computers . . . By the Millions, For the Millions" was the theme of Compcon '76, the 13th IEEE Computer Society International Conference held here recently, and of its keynote speaker, Robert W. Galvin, chairman of the board and chief executive officer of Motorola Semiconductor Products, Inc.

While the industry undoubtedly expects to provide DP devices "by the millions" to "the millions," the public, in the years ahead, it must do so by permitting users a direct interface with the logic of computer design and use, Galvin said.

Giving users this opportunity depends on the development of systems that have a "greater simplicity," are within the range of household pocketbooks and offer the best combination of features the public will want, he added.

Although Galvin couldn't predict how the industry will unlock the technical problems involved – particularly those of simplicity, he unreservedly affirmed the notion that making generally available computer devices is "the overall dream of the industry."

In addition, he suggested making such equipment affordable could be the most challenging aspect of the entire effort for the industry.

The most appealing aspect of the computer from the consumer viewpoint won't be its computational ability, but the facility it offers as an aid to help direct thinking, the keynote speaker predicted. He envisions families using the devices to provide logical checklists of things to think about when making decisions important to a household.

'20 Questions'

Users would play "a very fancy '20 Questions' game" with these "thinking devices," Galvin stated, stressing this kind of computer would not provide answers but would help consumers clarify the issues confronting them in such debates as whether to buy a home or a condominium or to rent an apartment.

If the public is to use computers in everyday life, however, consumers need to be taught to "systems think." Industry is responsible for actively encouraging this kind of education, he said.

Referring generally to experiments with fourth- and fifth-grade students which found average students are "easily grasping the principles of feedback and liking them," Galvin urged his audience to "embrace the advocacy of systems training for young children now so they will be competent to deal with systems tools in the future."

CW
At Compcon

Once "systems for the millions" are developed, the industry will have to work on improving communications. "We will need a broader band of communications . . . a project which zeros in on the concept of the wired city," he suggested.

Cable television and the entire spectrum of which TV is a part provide promising means of broadening the communications band, Galvin added, noting there will be technical and affordability problems with this industry dream as well.

If these problems can be overcome, however, users could conceivably employ unused TV channels to access the information today held within several volumes of the *Encyclopedia Britannica*, an observer hearing Galvin's address commented. TV sets would serve as display devices.

Amdahl Gets Award For DP Contributions

WASHINGTON, D.C. – Some 800 people turned out to attend Compcon '76, the 13th IEEE Computer Society International Conference, and to see the society present its most prestigious award to Dr. Gene M. Amdahl here recently.

Amdahl, who heads the corporation bearing his name and who was instrumental in the development of the Amdahl 470V/6, won the W. Wallace McDowell award.

Established through a grant by IBM to honor McDowell, its retired vice-president, the certificate and $1,000 cash prize were given to Amdahl "for his contributions to the architecture and design of computer systems and for his achievement in promoting advancements in the computer state of the art through business enterprise."

In addition to the 470V/6, Amdahl's computer system credits include major contributions to the IBM 704, IBM's "supercomputer" known as Stretch and its System 360.

Amdahl also helped develop the preliminary design for Ramo-Wooldridge Corp.'s RW300 and headed the group that proposed and designed the ARDC, a logical evaluator for file searches, for Ford Motor Co.'s Aeronautics Division.

The prize was accepted for Amdahl by his brother, Lowell D. Amdahl.

Proceedings of NCC '76 Now Available From Afips

MONTVALE, N.J. – The *Proceedings of the 1976 National Computer Conference* (NCC) is now available from the American Federation of Information Processing Societies, Inc. (Afips), the conference sponsor.

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U.S. Energy Data Collection Efforts Found Redundant

By Catherine Arnst
Of the CW Staff

WASHINGTON, D.C. – Two reports issued here indicate "new energy data collection efforts have been piled on top of old" by federal energy agencies, resulting in a plethora of information and information processing systems that cover the same ground.

A study released recently by the General Accounting Office (GAO) on federal energy data collection stated little has been done to remedy efforts in this area since a similar report analyzing the situation was made two years ago.

An investigation of the problem by the House Appropriations Committee, whose findings have not been officially released yet, reached a similar conclusion: The government's energy agencies are gathering "an enormous amount of data which has got to be duplicative" and "very expensive," according to Rep. Sidnay Yates, a member of the committee.

Yates read part of the committee's report during hearings held last March. Investigators talked to the Office of Management and Budget (OMB), Bureau of Mines, Geological Survey (GS), Federal Power Commission, the Bureau of the Census, the Energy Research and Development Agency and the Federal Energy Administration (FEA).

They found that "as of January 1976, the six agencies reviewed were using 223 active forms to collect energy data from the private sector which resulted in 1,462,000 annual responses and reports.

"Excluded from this number are duplicate copies and forms used to collect data which have not been approved by OMB or GAO. The amount of data collected on these forms is substantial and these agencies maintained 108 energy data systems to process the data."

GAO Report Figures

The GAO report contained more figures that indicate "the magnitude of federal energy data collection activity.

"There are 261 separate federal energy-related programs being administered by 44 federal agencies and bureaus. Four agencies account for over one-third of all energy data-related programs. The Federal government operates 98 separate computerized data bases or major files containing some form of energy-related data," the report said.

When the GAO looked at energy data collection in 1974, it concluded the only solution to data duplication was the establishment of an energy data system that would be independent of any existing agencies (See accompanying story on this page.)

"Nothing that has happened in the last two years has changed our views in that regard," the report stated.

"Federal agencies generally have continued to design information requests to fit their individual needs and efforts for improved coordination have yet to show much success."

Burdensome Data

Over the last two years, 18 energy-related bills have been enacted into law and, "in general, the legislation gave FEA significant data collection responsibilities.

"The legislation, however, did not give FEA any authority to influence the energy data collection efforts of other agencies. Thus, while FEA became a principal collector of energy data, its efforts were additive to the already existing as well as the new efforts of other agencies," the report said.

The data FEA is collecting, besides duplicating that of other agencies, is burdensome in itself, the report indicated. Since 1974, "FEA has imposed more than seven million man-hours of work on the private sector with 24 new forms," it said.

The appropriations committee was also critical of FEA's vast data collection efforts. "While some agencies had reasonably good inventories and control over their forms procedures, neither FEA nor GS has an effective inventory or control," the committee report said.

"FEA not only lacked a government-wide inventory of forms but, more significantly, did not know precisely what forms it was using. For example, FEA identified 83 forms as being in use to gather energy-related data, but at a later date FEA was unable to provide background data on 33 of these forms.

"In addition, supporting documentation of 25 forms, not a part of the original inventory, was supplied to the investigative staff," the report noted.

"The investigative staff was informed by one FEA official that even at headquarters personnel are 'blatantly flaunting laws and regulations regarding forms clearance.' FEA has been cited by industry as the major violator in the use of expired forms," the report stated.

During the House appropriations hearings, Eric Zausner, deputy administrator of the FEA, complained, "I find it a little disturbing when investigators go in; you can always find someone in an agency to say anything anybody wants."

He described a data dictionary the FEA maintains that catalogs "every single form and report that is prepared by the agency."

The GAO, however, is more concerned that data be reduced rather than inventoried by the FEA or any other agency.

GAO Proposes Independent Agency For Collection of Energy Data

WASHINGTON, D.C. – The General Accounting Office (GAO) report which found duplicative efforts in the area of federal energy information collecting practices recommended an independent data collection agency be established as "the best long-term organizational solution to energy data problems."

A similar proposal was made in S. 1864, a bill introduced in the Senate in June 1975. A committee report issued last August effectively killed the bill, however, adding an amendment to the Energy Conservation and Production Act instead.

The bill had proposed a National Energy Information Administration be established that would be independent of all existing energy agencies.

This agency would operate a centralized National Energy Information System that would coordinate data collection efforts of the different agencies and "assure the availability of standardized, accurate and credible energy information."

FEA Opposition

The Federal Energy Administration (FEA) opposed that proposal because "it threatened [its] existence and watered down [its] authority," according to Tom Laughlin, an aide to Sen. Floyd K. Haskell (D-Colo.), one of the bill's sponsors.

"FEA claimed that someone off in another agency just collecting data wouldn't understand what's needed. There were also arguments that it was more beneficial to have multiple data systems," Laughlin said.

A compromise was reached which would establish an Office of Energy Information and Analysis within FEA that would serve as "a focal point for the processing and analysis of energy data and information relevant to energy policy decision making."

FEA already has a legislative mandate to act as a focal point for energy data collection, but this mandate does not give FEA any authority to coordinate or streamline the energy data collection efforts of other agencies.

"Questions still could be raised regarding FEA's ability to establish itself as a credible source of objective energy data in view of its responsibility for energy policy analysis and development," the GAO report stated.

"Establishing a separate organizational unit for energy data collection within FEA and insulating it from energy policy analysis and development would be somewhat more difficult than in a Department of Energy and Natural Resources, but it should be possible," it added.

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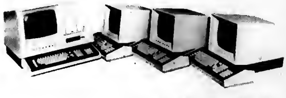

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200,000 Spotted Each Year

National Data Bank Keeping Bad Drivers off Roads

By Catherine Arnst
Of the CW Staff

WASHINGTON, D.C. – Approximately 200,000 bad drivers are being kept off the roads each year by states using the computerized National Driver Register (NDR).

Established by an act of Congress in 1961, the NDR is essentially an index of all drivers whose licenses have been suspended or revoked. When a person applies or reapplies for a license, a state can check with the NDR's data bank to see if his license had ever been removed by another state.

Forty-eight states and six jurisdictions (Guam, Puerto Rico, Panama Canal Zone, American Samoa, the Virgin Islands and Washington, D.C.) make 85,000 daily inquiries to the NDR, a total of about 22 million annually. The NDR processes the inquiries on its twin IBM 360/65s using a name-matching program designed in-house.

The result of this matching program is approximately 200,000 probable identifications annually of bad drivers.

"We call them 'probable identifications' because we are not sure if the hit is correct"; it is the responsibility of the state making the inquiry to go back to the state which allegedly suspended or revoked a driver's license to ascertain that the information is correct, according to James R. Lockard, assistant chief of the NDR.

All the states input to the system the names of drivers whose licenses have been removed, but the degree to which it is used to make inquiries varies, Lockard said. Twenty-four states check all applications for licenses, 23 check only original applications and not renewals and six check only on a "suspicious case" basis.

Florida and California do not make any inquiries (see box).

Aimed at Drunk Drivers

The register is not a data bank of all licensed drivers, Lockard emphasized – it only keeps track of bad drivers. It was the "intention of Congress that the NDR be aimed at the 3% to 4% of drivers" who may try to get a license in one state after losing it in another.

The NDR is particularly aimed at getting drunk drivers off the road, and about 52% of the probable identifications are of drivers whose licenses were removed for that offense, Lockard said.

Until 1966, the NDR only stored the names of drunk drivers, but it switched to cataloging anyone who had a license revoked or suspended for any reason because "many judges were too lenient and someone who was arrested for drunken driving would only be charged with reckless driving," Lockard said.

The NDR data base contains about 5.4 million records. It deletes a record after it has been in the system seven years if it has not received a clearing action from a state before then.

Inquiries are answered only if they are from a state's motor vehicle administrator or an individual asking for his own record. When the NDR testified at Sen. Sam Ervin's privacy hearings, that committee was "very, very enthusiastic about the register," Lockard said.

Accurate But Slow

The NDR, which costs $1.3 million per year to operate, is reasonably accurate and there have been few complaints from the states, Lockard said. The biggest problem is that it is slow.

Currently, inquiries are mailed in; the NDR processes them and mails a printout back. This process can take up to two and a half weeks, he explained.

More and more states, however, are going to a system where a license is granted over the counter when it is applied for and need instant communications ability.

The NDR surveyed its users and found 45 desire a rapid response system. A feasibility study of that is being done now, Lockard said.

Too Slow for Florida

TALLAHASSEE, Fla. – Florida does not query the National Driver Register (NDR) about applicants for drivers' licenses in that state because it "uses a high-speed data system that is not compatible with our own horse-and-buggy computer," according to an NDR spokesman.

Licenses are granted at the time of application in Florida through the use of an on-line computer system.

A total of 150 Burroughs TC 532 terminals located throughout the state allow immediate access to the state's central data bank.

When a person applies for a driver's license, his name is checked against the central file to ascertain whether he has ever had a license suspended or revoked in Florida. If not, the license is granted.

The time needed to access the NDR data bank prohibits Florida from checking an applicant's record in other states, according to Alan Cochrane, assistant director for the Division of Drivers' Licenses. There is a delay of approximately two and a half weeks between the time an inquiry is made of the NDR and an answer received, he claimed, because of the slow mailing process.

"I don't believe Florida is a haven for bad drivers," Cochrane said. The state does sometimes use the register on a suspicious case basis.

GSA Testing Grants Data Base Awaiting Approval by Congress

WASHINGTON, D.C. – The General Services Administration (GSA) has begun testing a data bank of federal domestic grants authorized by a bill which passed the Senate earlier this summer [CW, July 19].

The proposal for the data bank is now pending before the House of Representatives.

Four cities – Louisville, Ky.; Philadelphia; Omaha, Neb.; and Los Angeles – are involved in testing "Project First," a system originally designed by the U.S. Department of Agriculture.

The GSA is making this federal assistance available to these test cities through its federal information centers located in each of the four areas.

The Department of Agriculture eventually hopes to maintain data on all existing federal grants to assist communities in determining whether they are available for any particular government program. Some 600 of these programs are included in the data bank now.

If the system becomes law, the GSA would be the federal agency responsible for running it, according to Paul Kugler, director of the plans and program staff in the Department of Agriculture's Rural Development Service.

Project First will be operational for a total of three months: testing should be completed sometime in November.

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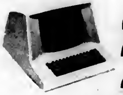

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Editorials

Maintaining Corporate Control

Corporate management must maintain continuing control of its DP operations.

This not-so-startling statement takes on added emphasis in the light of two recent news stories [CW, Sept. 13]. In both cases, events in the DP centers were directly affecting the profits of the companies and, perhaps, the survival of the firms involved.

In the first case a fraud ring allegedly was operating within the affected company to alter credit records. If the charges brought in this case are accurate, a clerk was able to access a data base containing information on untold numbers of consumers.

The integrity of the credit-granting firm was directly tied to the accuracy of the credit records. And, more importantly, credit frauds may have resulted from altered records.

A credit-authorizing company which maintains large sensitive data bases typically devotes considerable attention to internal security. And yet this system was compromised not by a member of top management, but by a clerk who routinely altered records as part of her job function.

In the second case, a company put itself in the hands of a facilities management firm which promised to assume full control over the DP operation. The client company has now charged that the facilities management firm did not provide the promised DP results and kept inaccurate reports from management.

In both situations, management apparently was under the assumption that the DP operations were functioning smoothly. Even if the defendants in both cases were acquitted of any wrongdoing, the alleged abuses are still possible despite the continuing emphasis on DP security and control.

The DP operation is the nerve center of corporate viability. Management must continually audit and control its computer systems to be eternally vigilant against unusual or unexpected events.

The lifeblood of the corporation may depend on it.

Nobody by That Name Here

The following letter, addressed to

Mr. Computerworld
News Desk
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would certainly be a candidate for the *New Yorker* magazine's "letters we never finished reading" department:

"Dear Reader:

"It's been a struggle. But at last we've found you.

"After screening literally hundreds of mailing lists, we came up with a relative handful of names like yours — names of people who . . ."

Humorous, sure. But, unintentionally, it also illustrates a serious point for DP organizations, especially those that utilize mass mailings based on hired lists and those that offer the use of such lists.

Far more discrimination is needed to make sure the mailed pitch is well directed.

We all complain about the quality and the cost of mail service; perhaps one more single-digit field in a mailing list record would be enough to flag those that refer only to organizations and not to real people.

Campaigns with personalized pitches wouldn't pick up the flagged records. The cost of a campaign would be decreased; so would the volume of mail.

It seems wrong to always complain about the mail service without at least being willing to suggest an idea that might have some positive impact on the system.

'I Need a Staff DP Manager Who Can Convert a Foregone Conclusion Into a Smoothly Orchestrated, Computer-Generated Sequence of Crystal-Clear, Logical Reasoning."

Letters to The Editor

Prime Deterrent to DP Crime Seen as Emerging DP Auditor

Regarding Alan Taylor's article on computer crime [CW, Sept. 6] and the *Boston Globe* article which he referenced, it seems to me the authors have either knowingly or unknowingly avoided mentioning one of the prime deterrents to computer crime — the DP auditor.

Although we are few in number at present and admittedly have been slow to gain recognition, our forces are growing rapidly.

Represented by such organizations as the EDP Auditors Association and the Institute of Internal Auditors, our function is to review the control and security procedures employed in DP installations.

By using techniques such as Integrated Test Facility, test decking, simulation and various audit software tools, new and existing software systems continually pass our reviews.

In addition, the monitoring of DP shops' adherence to standards gives us the unique ability to oversee the entire computer department.

People should be aware that there is a profession whose sole responsibility is to act as a "watch dog" over the DP environment.

Michael I. Sobol
President
New England Chapter
EDP Auditors Association
Framingham, Mass.

Data Past

Five Years Ago
Sept. 22, 1971

The main social impact of the computer between 1946 and 1971 was seen by J. Presper Eckert Jr. as the elimination of human bookkeeping. In 1960, "Half of all our manpower went into clerical work," he said. John W. Mauchly, who developed Eniac with Eckert in 1946, saw computers becoming increasingly cheaper, he stated in a *Computerworld* interview on the 25th anniversary of Eniac.

– – –

WHITE PLAINS, N.Y. — IBM continued to ease back toward bundled systems engineering with an announcement it would provide individually tailored, fully operational programs at fixed prices for users of its 3/6 CPU. IBM said it would provide RPG-II source code for programs designed under the Application Customizer Service for the users.

Eight Years Ago
Sept. 18, 1968

HARRISBURG, Pa. — In an effort to establish proper objectives, content material and appropriate terms for DP education courses in business schools here — as opposed to courses in keypunch operation — the State Board of Private Business Schools stipulated that prospective pupils at private DP schools in the state pass the IBM Programmer Aptitude Test with 36 points or better.

– – –

LAS VEGAS — Four men were arrested in connection with a $1 million Diners Club credit-card fraud which took place at local casinos here. The fraudulent cards were duplicates of real members' cards — a design which enabled charges to be processed on the club's computers, programmed to reject phony accounts.

300% Turnaround Unimaginable

The article by Hanks and Ingram, "Minis, Satellites Cut Marine Corps Turnaround 300%" [CW, Aug. 30], contained an error I would not be surprised to see in a daily newspaper. I was amazed, though, to see it in *Computerworld*.

Had turnaround been cut 100%, it would have been slashed to zero. Therefore, a cut of 300% is really hard to imagine.

Steve Turek
Kansas City, Mo.

It's Dutch, Not Deutsch...

In reference to the article about Philips Gloeilampenfabrieken [CW, Aug. 30], I might judge that you people speak neither Dutch nor German.

Otherwise, you would have known that "Gloeilampenfabrieken" is a pure Dutch and not "Deutsch" (German) word. It means "light bulb factories."

Nowadays, Philips is a huge electronics company with headquarters in The Netherlands and plants all over the world, but Mr. Philips started out in Eindhoven, The Netherlands by making lightbulbs.

John Klein
Santa Barbara, Calif.

...And Extremely Dutch at That

I would like to say that Philips Gloeilampenfabrieken (literally translated as "glowing light factories") is extremely Dutch and not German, as is its computer division — Philips Electrologica.

I have not yet seen this year's Fortune 500 list, but I would not be surprised if the top two corporations are also based in good old, little Holland — namely Royal Dutch-Shell and Unilever.

Dick Barton
Hoofddorp, The Netherlands

(Other letters on Page 14.)

The British Dilemma

Although the food, at least at the plebeian, fresh-cut-sandwiches, luncheon-vouchers-honored-here level, is kilometers from the French standard, Britain too has a computer dilemma. It is one of the more civilized countries, where people have learned to ease the frictions caused by limited space and resources and a large, poorly-distributed population, with many little courtesies and a lot of peaceful queuing. I have many, many friends there, from big shots like Boz Ferranti and Reay Atkinson to youngsters in the software houses. I read their computer papers, including the one associated with CW; I belong to their computer society; I love 'em dearly. But wow! do they have problems: economic, social – and technological.

Unlike the French, the English were early in our art. Babbage – not von Neumann, not Aiken, not even Herman Hollerith – was the real Father Of Us All. Equally peculiar, and much less adept at tapping the government purse, was Alan Turing, the first theorist, the first computer scientist. Maurice Wilkes beat out the EDVAC, NPL was not far behind Sam Alexander at NBS; the very first large scale business data processing installation was at Lyons Corner Tea Houses, a year before the Philadelphia 701 and two years before the Louisville UNIVAC.

But native enterprise was miles and years and dozens of IQ points behind native ingenuity, especially in the marketing/sales arena. IBM dissolved its relationship with British Tab, National Point-of-Sale switched its Scottish factories from brass-by-the-ton to germanium and silicon, Honeywell and Burroughs made useful incursions. The Londoners and Mancunians were brave at first, and brought out LEOs and ATLASes. Component houses like Plessey, communications outfits like Marconi, separately-directed American subsidiaries like Standard T&C made contributions. Their technology was good, their WWII-generated reservoir of basic science was still full, their software artistry was terrific, and less infested with curlicues than ours. But the management thrust, the risk capital, the hot-rock salesmanship were sadly lacking. The various ventures merged, merged again, reorganized. Out of it came a single British hardware supplier; ICL, International Computers Limited.

The six or seven mergees were poorly digested – remember, the Philadelphia and St. Paul Univackers have problems after twenty years! They had to reach out to American marketing experience for top executives. Still and all, there *was* a national enterprise. There had not been the humiliation of a Bull-GE-Honeywell sell-off. And the profession, the trade, was much more concerned, much more vocal about the successes and the failures of the ICL venture than in our country.

But then the dilemma began to be clear: how to support ICL against the IBMs and the Honeywells and the NCRs? By research and development subventions? I said yes, loudly, to the concerned parliamentary subcommittee, and in many U.K. speeches. By preferential procurement – national, nationalized industry, county/regional, local government? I said no: a dangerous prop. Well, they went both ways: some direct support; vigorous but not completely effective preference in purchasing. British Airways, local councils were reluctant; the Whitehall boys had limited powers and weren't all that certain – and that is the very center of the dilemma.

Because, you see, IBM and Honeywell and NCR and DEC, and other American firms, *manufacture* in Britain. Most of them manufacture more hardware and software than they sell inside U.K. They generate local employment, pay very well indeed, and produce an export balance. I don't have figures, but would guess that the wages and salaries paid in U.K. by American computer outfits substantially exceed those paid by ICL. The trade balance thing would be on ICL's side, of course, since it sells thirty percent of its production abroad and manufactures only at home so far. I'm talking about *net* manufacture of hardware and software; both sides import a great deal of components and subsystems.

So there you have it: the "American" firms are in fact just about as valuable to the British economy and to their British employees as is ICL. Because of much better sales and support practices, they are frequently better for the British user. Is it wise to try to hold the Americans down, and push ICL? One might argue that less sales by IBM means more sales by ICL. Sure, but not as much; IBM sells magnificently, even in U.K. IBM ships its profits out – yes, but it has many British shareowners. On balance, I still think my old 1972 advice was right: feed in R&D money and leave the marketplace alone. Science and technology are what Britain needs, in every field – crutches, no!

Herb Grosch

Airline Overbooking Exemplifies Classic DP Problem

Overbooking is one of the great phenomena of the computer age. Use of adjustable formulas based on various histories (calendar, day, event occurrence, weekday, overall trend, etc.) are routinely calculated for every flight made in this country by the major scheduled airlines.

The Taylor Report

By

Alan Taylor, CDP

Overall, the system works well. For every 51 passengers overbooked, only one was bumped from a flight, according to 1975-76 figures presented by Richard Ferris, United Airlines president.

This is a useful figure, showing a 2% failure rate for the system. But before we cheer and look the other way, we should take a look at the overall problem.

The overbooking problem is certainly one of the classic business/computer problems and, while being one of the first, it will not be the last. It is useful for all computer professionals to consider its characteristics to see the problems that are going to be involved in computer solutions and optimizations in many areas.

In the past this was not possible because the airlines kept much of the necessary knowledge from the profession. Now, under the pressure of the courts, some of the figures are being released.

Overbooking Definitions

The best available data comes from United, where the overbooking problem is now defined as deliberately confirming seats beyond capacity, according to Ferris. This is very different from the Civil Aeronautics Board (CAB) definition, which is based upon the number of confirmed bookings not honored.

How these differ can be realized by considering the odds. Bumped passengers on United totaled about 1 in 2,000, but overbooked seats were 1 in 30. It is clear that the overbooking problem is much bigger than the bumping problem.

In fact, Ferris' definition does not go far enough. While he said a million overcapacity seats were booked on "certain" flights, he did not reveal the total capacity of those flights or of the flights on which anyone was bumped.

These total capacity figures are important in sizing the problem. Overbooking does not just affect the passengers who are confirmed when there is no space available – it affects all the passengers on the plane.

Here lies the difference between the overbooking system and the more conventional wait-list system. No passenger on an overbooked plane really gets a confirmed seat under overbooking. The choice as to which passengers are to be bumped is not restricted to the late bookers, but can be anyone.

Another figure Ferris did not reveal is the number of confirmed bookings United gave out. However, a reasonable estimate of this can be obtained as follows from the figures he did give.

Number of Bookings Issued = Number of Bookings Honored + Number of Bookings Dishonored + Number of No-Shows

Ferris said 30,250,157 bookings were honored, 16,545 were not and United experienced 10% to 15% no-shows. Using a 12.5% no-show figure, this equals about 34 million bookings accepted.

We can now size the problem as follows:

Bookings Issued Within Capacity = 33 million.
Bookings Issued Outside Capacity = 1 million.
Passengers Put at Risk = 10 million.
Passengers Not Showing = 5 million.

That's the best way I can see to size the problem. But what about the computerized solution? What are its parameters?

Although Ferris' figures are the best available, they are incomplete. They don't show the number of overbooked passengers who asked for room on the flights. However, this can apparently be worked out from the number of overbooked passengers carried and the number bumped. These, together with the number of overbookings, provide some idea of the solution. The data follows:

Bookings Issued Outside Capacity	1,081,082
Outside Capacity No-Shows	222,100
Outside Capacity Seated	842,837
Outside Capacity Bumped	16,545

Other possible solutions could give other figures, but at least this gives the data of the current solution. Current figures, however, only reflect the current position. What about the future? Are our techniques getting better? Can we expect next year's figures to be better? Or worse?

Here we have the greatest amount of missing data. We don't have any history of the prior success of United or any other airlines in handling the system. We do know that in aggregate the number of bumped passengers rose from 94,000 to 102,000 between 1974 and 1975, according to CAB reports. But what happened to capacity?

The overbooking problem catches anyone, as seen from this file photo of a group of overbooked people, including the writer, milling around an airport counter on the way to a DP conference. The solution was an all-night bus journey.

Certainly any increase is grounds for suspecting the worse; so are the current trends in airline travel. Ferris commented that 1976 is an unexpectedly strong year – with the increase in flights actually observed nearly double (at 10.5%) the expected 6.5%. And 1977 is going to be strong also.

These figures also tend to suggest that more flights are going to be overbooked in the future. In conjunction with the CAB reports, they suggest that some other solution or some improvement in the current solution would be of help to everyone.

The search for improvement appears to be the goal of any computerized optimizing technique such as overbooking. Probably some of this column's readers have ideas about it or know who else has published material on this area. Certainly some will know why publication of material is not always reliable or carried out.

I'd be glad to hear from all sides. From the computer technical area this is the real problem: How do we best improve an optimizing solution while it is running?

Overbooking is one such case – but there will be others. If we understand this, all problems may be helped a little. So I'll wait to hear from you.

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Letters to the Editor

Taylor Column on Privacy Showed What Model Can Do

I would like to compliment Alan Taylor on his articla, "Model Pinpoints Total Cost to Implement Privacy Act" [CW, Aug. 23]. The explanation of the model was vary clear and, in my opinion, gave the reader a good fael for what the model can do.

It should be pointed out, however, that most of the work that went into model development was accomplished by Robert C. Goldstein.

My participation has been that of a user who has fine tuned the model to fit specific personal data base considerations.

Henry H. Seward
D.P. Management Corp.
Lexington, Mass.

Question Inaptly Phrased

Regarding the letter by Anita N. Benson [CW, Aug. 16], the question at the end of the letter was inappropriate to computers.

". . . Would you prefer mass-produced Mediterranean modern or a handcrafted piece, made with pride, that will last a lifetime and be a joy to use?" would have been more aptly stated as "Would you prefer a handmade high-performance car or a mass-produced Chevy Nova?"

The high-performance car is nice, but what do I do when I need service?

A small businessman cannot afford to rewrite his programs every time the tax rate changes and he cannot afford to call a software consultant of Benson's caliber every time a program needs maintenance. Maintenance is more important than a beautiful system.

Before Benson asked her question, she should have realizad most furnitura (and computer programs) will be used in an office reception room. For use thare, it must be cheap and easily replaced.

Tha computer is a tool like a wrench or adding machine, not a work of art in itself.

William L. Roberts
Coatesville, Pa.

It Also Manufactures It

In reference to your coverage of automatic fingerprint identification technology [CW, Aug. 9] we wish to emphaticslly correct one item in the article.

The ". . . hardware already developed by Calspan" is also manufactured by Calspan, which has patents issued and pending upon the hardware and which owns the registered trademark "Finder" for these fingerprint readers. "Lifter" is also a trademark of Calspan Corp.

C.W. Swonger
Vice-President
Calspan Technology Products, Inc.
Buffalo, N.Y.

Can You Help Them?

We are using magnetic tape cartridges as output to a telephone message detail system. The 1/4-in. 3M Co. cartridge provides data that conforms to the proposed Ansi standard, X3BS/75-43.

We would like to convert the cartridge to 800- or 1,600 bit/in. 9-track tape or process the cartridge as-is.

Could *Computerworld* or its readers help us?

John A. Neal
Control Products, Inc.
East Hanover, N.J.

DOS/RS™ now uses 3270 CRT system console control.

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Although It May Not Be Anything New

'Software Physics' Standardizes DP Operations

By Barry A. Stevens
Special to Computerworld

DP management currently relies on an apparently haphazard collection of definitions and methodologies to perform required operational functions such as forecasting, equipment planning, cost allocation and operational analysis and improvement. This has created a situation in which different people working at the same installation and solving the same problem can obtain different results and reach different conclusions.

This has, to say the least, an unsettling effect on management; it is not a very satisfactory way to run a business.

Several years ago, Ken Kolence set out to correct this situation through a carefully constructed set of definitions and relationships intended to describe basic terms, concepts and procedures used to manage the DP function.

Drawing heavily on analogies between the physical sciences and the behavior of DP systems, Kolence named the new discipline "software physics."

Literature describing software physics concepts began appearing in trade publications as early as 1972, but did not become generally available until Kolence founded the Institute for Software Engineering in 1975.

The Institute publishes materials on software physics and conducts a nationwide seminar series on the topic. These activities have attracted considerable attention.

The steadily increasing visibility of software physics has, understandably, evoked reactions from the DP community, and it is those reactions that this article sets out to explore. In preparing this material, we talked with vendors of hardware and software monitoring tools, hardware system vendors, students in the institute's seminar series, organizational and individual supporters of the institute's activities and collected a reasonable sampling of professional opinion from the DP community.

During this process, we encountered quite a spectrum of opinion ranging from enthusiastic, almost messianic support to overwhelmingly negative "knee-jerk" reactions.

The picture which emerged from this effort was one in which the scope and potential usefulness of software physics was greater than its most vehement detractors allowed, but less than envisioned by its most enthusiastic supporters.

Unlike most contributions to Computerworld, *the accompanying article was read prior to publication by a number of people deeply involved in computer performance evaluation, including Ken Kolence.*

While the author made a number of changes to his original text, he recognizes that what he has to say will still bother some people. Hopefully they will feel free to respond so a clear picture of software physics can emerge.

Comments on this article can be sent to Don Leavitt, Associate Editor/Software, Computerworld, *797 Washington St., Newton, Mass. 02160.*

It was obvious that extreme reactions, on both sides, were not very well thought-out, and need refinement and further investigation to provide substance. Finally, it became apparent that significant practical application is required if the premises underlying software physics are to be proven and ultimately accepted by the DP community.

But what is software physics? What is it intended to do and what are its limitations?

Definition of System

Software physics defines a computing system in terms of processors and storages. Anything that can execute instructions is a processor, including central processors, channels and control units. Anything that can hold data is a storage, including buffers, high-speed cache memory, main storage, disks, tapes, cards and printer paper.

When programs are run, work is done, in software physics terms, when program instructions cause processors to move data from one storage type to another (the precise definition is that storage is *altered*).

The capability of a given system to effect that transfer is called the "power" of a system. The amount of power that a specific configuration is capable of delivering to a specific workload is largely determined by the workload and determines the execution time required to process the work. Execution time is a very precisely defined term in software physics.

The entire process is described using equations of the form:

$$P = \frac{W}{T}$$

Notational complexity arises when this relatively simple equation is spplied first to subconfigurations within a computing system, then to the system and workload as a whole.

A workload is described in terms of the amount of work required of various elements of a DP system. This may be derived through the construction of a descriptive vector for each job, then for the workload as a whole, and can assume the form:

	SEC CPU	IO1	IO2	IO3
JOBAAA	100	1,000	0	1,000
JOBAAB	1	10,000	5,000	400
JOBAAC	10	2,500	150	2,400

Each vector may then be accumulated into a total using an equation of the form:

$$W = a_1 \times CPU + a_2 \times IO_1 + a_3 \times IO_2 \ldots$$

where the constants are empirically derived. These constants describe, in effect, the ability of the hardware system to do work for the specific workload being characterized.

If the constant values are correctly chosen and the data elements are converted to units of software work, the resulting values of software work, W, will be in terms of "works," "kiloworks" or "megaworks," the unit of work used throughout software physics.

These values, using computational procedures defined in software physics materials, can be used to allocate DP costs, determine system capacity requirements, calculate system capacity and form the basis for workload forecasting and equipment planning procedures.

The equation for software work is of

(Continued on Page 18)

Some OS/MVT Support Seen Despite Phaseout Announcement

WHITE PLAINS, N.Y. – Although IBM recently notified users it would drop the 360-based operating systems, OS/MFT and OS/MVT, from Class B to Class C support next year [CW, July 5], it hasn't given up on these users yet.

One of the company's "blue letters" (for internal use only) dated in late August described a programming Request for Price Quotation (RPQ) – or specially priced piece of software – that has been designed to support IBM 3350 and 3330-11 disk subsystems under OS/MVT Release 21.8 on large-scale non-virtual 370s.

Cataloged as 2799-ARG, the package is considered by IBM to be a "unique alteration, not generally applicable" to all users. It therefore carries a monthly license fee of its own – $300 – although the operating system and most other device support software has traditionally been provided free by IBM as "intrinsic to the functioning" of the computer system on which it is to be used.

While the timing of the package availability has been a surprise to some observers, the pricing has not. IBM seems to be trending toward, in effect, breaking the operating system apart and putting price tags on the pieces, they noted.

Ultimately there will be a small skeleton and users will have to become "far more sophisticated" in order to "flesh out" that base with the right add-ons, they added.

The capabilities of 2799-ARG are "interesting" to some observers and appear to be aimed at third-party lessees. The package does not, for example, support any of the IBM 2300 line of disk units except the 2314, nor does it support the original 3330s or the 3340 disk modules.

It does not function in the OS/MFT mode, nor does it support TSO swapping or the "starter system" facility for the 3330-11. This latter omission means users require a "standard" 3330 for system generation; if the starter was in place, they could work from the 3330-11.

Commenting on the RPQ, a spokesman for Itel noted that his company has provided support for the 3350 and the 3330-11s on its modification of the operating system and that the Itel software costs only $200/mo.

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Cullinane Information System 1:00-3:00 p.m.

An introduction to the direction the Cullinane Corporation is taking in providing their clients with a complete information system. Cullinane developments include a Data Dictionary, The SHADOW II Communications Monitor, On-Line Query System, Distributed Data Processing and Mini-Computer versions of IDMS. Also covered will be the CULPRIT Retrieval System and user department versions such as EDP-AUDITOR and EEO-AFFIRMATIVE ACTION REPORTER.

Social 3:00-4:00 p.m.

Opportunity to discuss specific questions in depth with members of the Cullinane Corporation Technical and Management Staffs in a relaxed and casual environment.

Seminar Leaders

Robert J. Davis – Mr. Davis is Regional Marketing Manager for Database Systems. He has extensive experience with most aspects of database system design and usage, and has held key positions with both IBM and CINCOM. He is responsible for the marketing of database products in the U.S. and Canada, analyzing competitive products, and finding new markets for database technology. Mr. Davis holds a B.S. degree from the University of Akron.

William E. Linn – Dr. Linn is a member of the Cullinane Corporation Senior Technical Staff. His responsibilities include IDMS training, database consulting and technical marketing support. He was previously with Southern Railway System in Atlanta where he was deeply involved with database administration activities with IDMS. He has his Ph.D. in Computer Science from the University of Michigan and has been associated with the Georgia Institute of Technology teaching data structures and list processing techniques.

Raymond J. Nawara – Mr. Nawara is Southwest/Plains Area Manager of Cullinane Corporation. He has had extensive experience with the design of health and patient-care systems. Previously he was the Data Base Administrator at the Health and Hospitals Governing Commission of Cook County, Illinois where he had extensive experience using IMS. He has consulted in Database Applications for a variety of clients. Mr. Nawara is a graduate of the University of Houston with a major in Mathematics and Computer Sciences.

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HP Puts APL on 3000 Series II With Software/Firmware Duo

PALO ALTO, Calif. – Hewlett-Packard Co. (HP) has extended the capabilities of its HP 3000 Series II with the introduction of a multiuser APL language package (APL/3000) and an optional CRT-based terminal with a full APL character set.

The software/firmware combination that makes up APL/3000 is said to be capable of supporting 12 or more concurrent users, each with an APL workspace that is effectively limited in size only by the available disk space.

For users who may not yet be comfortable with the APL notation, HP includes a facility – called APLgol – which allows the definition of functions in simpler terms.

Using keywords to define the functions, APLgol combines the maintainability and reading ease of structured programming with the power of APL, HP said.

The language processor underlying APL/3000 is a "dynamic, increment" compiler and not "merely" an interpreter, the company emphasized. This distinction means that, once compiled, object code is available for use again and again so long as tests for appropriateness are met, a spokesman explained.

The use of fully compiled code can cause "dramatic speedups" in the execution time of large programs, particularly those with much internal repetition, he added.

The APL/3000 Editor is a full text editor as well as a full function editor, HP said. Commands are English-like words: some like UNDO, which returns a programmer to his position before the previous edit command, are unique to APL/3000, the spokesman claimed.

Since APL is treated as a standard language subsystem under the HP 3000 operating system, users are free to use any of the other languages while APL operations are in progress, HP said. In that connection, the company noted the HP 2641A terminal, being introduced now, can be switched from APL to Ascii to support the user's language choice at any time.

The CRT on the 2641A has a high resolution, allowing immediate and clear display of APL characters created, in some cases, by overstriking two individual keyboard characters, HP said. The keys generally utilize a bit-pairing approach with an Ascii and an APL character on each, the spokesman added.

The 2641A is microprocessor-controlled, allowing user-defined function keys; when used in Ascii mode, it is teletypewriter-compatible in asynchronous or bisynchronous operations, HP said.

Cost of the firmware/software APL/3000 package – which can be field-installed on existing HP 3000-IIs – is $15,000. The 2641A terminal costs from $14,100 up depending on memory and other options.

First deliveries of APL/3000 and the 2641A are expected in November, HP said from 1501 Page Mill Road, Palo Alto, Calif. 94304.

Round-the-Clock T/S Ready for D.C. Users

RESTON, Va. – Accounting firms and small businesses in the Washington, D.C., area may be able to get the computing capability they need through a fixed-price, round-the-clock time-sharing service from Dynamic Computers, Inc. (Dynacom).

The seven day/week service provides unlimited use of a Westinghouse 2500-based mini system located here over dial-up lines. Software applications already available include inventory, accounts receivable, payroll and general ledger, Dynacom said.

Users may write additional programs, apparently in RPG or Fortran, or modify the existing ones, which are in Fortran.

A "daisy-wheel" terminal, based on the Diablo print mechanism, and on-line storage of 6,000 disk records as well as use of the software is included in the $500/mo cost of the Dynacom service.

Communications costs are not included, the spokesman emphasized.

More disk space is available at the rate of $25/mo for each additional block of 6,000 records, he said from 11800 Sunrise Valley Drive, Reston, Va. 22091.

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'Software Physics' Standardizes Operation Jobs

(Continued from Page 15)

essentially the same form as that used by existing job-accounting methods to compute the charges for a job; Boeing Computer Services, Inc.'s (BCS) Sara package, for example, computes the Computer Resource Unit in essentially the same form.

The internal computation of job charges in Value Computing's packages is of a similar form; the computational method behind IBM's Service Unit in the System Resource Manager is essentially the same as well.

In software physics, however, although the same form is used, the elements of the table are first converted to units of software work.. I/O activity, initially in EXCPS for example, msy be converted to work by multiplying the number of EXCPs by the average block size of the records moved. The result when the elements of work are summed up for each job is intended to be a value of total work that is invariant.

BCS has implemented this method in the latest version of the Sara job-accounting package. According to BCS, the constants used for the computation of software work are available to Sara users who are members of the Institute for Software Engineering.

An important premise behind software physics is that the resulting value for software work for any job is the same, no matter what, unless the program or data are in some way altered.

It will be interesting to follow published results as Sara and the other vendors' packages are used to determine the value of software work for actual workloads. If the computed value of work actually remains constant for each job, a major problem in accounting for machine resources will have been solved.

The responses to software physics have been quite varied. A common response was voiced by John Caron, an analyst at the Federal Computer Performance Evaluation and Simulation Center, who feels "software physics is the same old good management topics with a new label."

Mike Morris, an independent consultant, concurred: "Software physics contains nothing really new. It does provide a well thought-out, structured approach [to common concerns in DP] using a consistent notation. I look forward to applying it to practical situations."

There are, however, at least two interpretations for the "nothing new in software physics" response. The first is that software physics really is nothing new.

In the second case, observers believe software physics doesn't *do* anything new in DP – equipment planning, cost allocation, workload characterization and capacity analysis have been around for some time.

But software physics provides a methodology for performing these functions using standard definitions, uniform notation and defined computational procedures. And *that* is new to DP.

In the opinion of many observers, software physics can make a positive contribution even if it does not contain anything new. Philip J. Kiviat, chairman of Sigmetrics, feels "the biggest contribution of software physics is in the organization it provides . . . and that is a healthy thing. I'd like to see more written, especially by those who are trying to use it."

And, in what may prove to be a most significant view, Dan Momjian, vice-president for banking systema at the Bank Administration Institute (BAI), described Kolence's work in software physics for BAI as "an outstanding job of cost allocation."

Treatment of time, not particularly easy in a multiprogramming environment, is still aticky in software physics. Precise definitions are provided for execution time, for example, which in a single-thread environment is equivalent to the single-thread processing time but, in a multithread environment, is neither the single-thread time nor the elapsed time for the program.

It appears to this and other observers that processing delays are not accounted for using software physics and must be introduced by using additional measurement projects to determine such delays and then combining those results with software physics to arrive at a true turnaround or response time.

If this is true (and Kolence insists it is not true) and service levels are an important part of any capacity mansgement system (as all seem to agree), this is seen as an important shortcoming in software physics.

Another response to software physics is that it needs to be brought down to a practical level and that additional work is required to demonstrate the validity of basic concepts and to provide practical illustration of its utility.

Momjian noted "technicians have responded very favorably, while users and management haven't responded as quickly . . . Kolence's work needs a layman's interpretation."

And Joe Magliolo, section manager at American National Life Insurance, described a potential use for software physics at his installation: "I plan to study it more and introduce the notation at our installation. Its use in workload forecasting, for example, should make it unnecessary to continually test assumptions made and reasoning used in the preparation of a forecast, thus simplifying the process."

Other tests of software physics are in progress, including use of software physics methods to compute billing rate constants, comparative analysis of tape drive performance and benchmark comparisons between predicted and actual values of software work.

The reaction to software physics is pretty much as can be expected at this point. In spite of what some observers consider to be limitations in its use, software physics has still, in the view of others, made a positive contribution.

Stevens is an independent performance consultant and an associate editor of EDP/Performance Review, *published by Applied Computer Research of Phoenix, Ariz.*

'Cuffs' Ready for In-House Use

WAKEFIELD, Mass. – The Combs-Unangst Financial Forecasting System (Cuffs), previously available only on time-sharing networks, is now available from Sofco, Inc. as a package for in-house Digital Equipment Corp. Decsystem-10s and -20s.

Said to support a user language "very close" to English and to be easier to use than other similar systems, Cuffa handles complex problems such as seasonality, constraints on capitalizations and least-squares regressions as well, Sofco claimed.

Said to be capable of consolidating 500 subsidiary items at multiple levels, Cuffs costs $20,000 to $25,000. Monthly lease plans are available from Sofco at 4 Lakeside Office Park, Wakefield, Mass. 01880.

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Six Ways to Go About It

Personal Initiative Only Way to Learn Documentation

By Joseph T. Rigo
Special to Computerworld

A lot of companies have decided it is finally time to do something about their documentation problem. And they are going about it in a most peculiar way.

First, they give the job to a person who has no prior experience or training in systems documentation. Next, they assign this person to work under a manager who hasn't the foggiest idea of what to expect from a technical writer.

And then they issue the commandment, "Go forth and document!"

Characteristically, the writer is a bright young person who digs in conscientiously and really tries to do a good job. Sometimes it works. More often it doesn't.

The Spark

The accompanying article was written in response to the following letter, which our reader asked us to forward to the author:

Dear Mr. Rigo:

I caught your Reader Commentary ["Too Many Examples Better Than Not Enough for User" (CW, Aug. 16)] and noticed you are now the president of a documentation consulting group.

Would you please tell me where I can get some good guidelines on how to document a system? I work for a large insurance firm, am their only tech writer, their first one. They hired me on the strength of my potential and don't know a damn thing more about documentation than I do.

If you could steer me in any useful direction at all, I would vastly appreciate it!

Gratefully Yours,
(Name Withheld)

There is no place to go for easy answers. There is a lot of literature about how to document single programs, but the subject of large corporate and governmental applications has barely been touched.

So, given this general situation, what do you do?

- *Learn to program.*

You don't have to become a great programmer, but you must be able to go into a listing to find an answer you need. You also must be able to understand what the people around you are talking about.

Most importantly, you must be able to use any system you are documenting. This is the only way you can find out how it really works.

- *Go live with your users.*

Get an assignment to document clerical procedures in one of your user departments. Find out why they hate the systems staff. Learn what really interests them in a new computer system.

While you are at it, get some of the standard technical writing books and experiment with different techniques. Learn the difference between good documentation and good writing.

- *Join a development project.*

Join the team full-time when it is starting to develop requirements for a new system. Stick with it through the last user manual. There is plenty of documentation to be produced, and you can free a systems analyst for active duty.

Be careful, though. Other members of the team will ask you to fix up the spelling and grammar in their reports. This sort of help will improve their productivity enormously but don't let it take up more than 10% of your time.

- *Join Sicdoc.*

Sicdoc is the Special Interest Committee for System Documentation. Information is available from the Association for Computing Machinery, 1133 Sixth Ave., New York, N.Y. 10036.

- *Learn about the tools of your trade.*

Learn to produce Hipo diagrams, reference charts, tables and illustrations. Find out about text editors and automated documentation programs. They won't help you produce the first draft, but they save a lot of time in updating and maintenance.

- *Develop different styles for different users.*

Computer operators don't have time to read. They want diagrams with symbolic labels.

Programmers never look at anything except a listing. You have to figure out how to guide them to the right one when the system has 148 modules. You also have to tell them what those funny variable names stand for.

In your spare time, work with them to develop standards for programming so the listing will be structured in a sensible way.

Managers like to see Gantt charts about time and cost. They can't read anything longer than one page. System documentation puts them to sleep – especially right after lunch.

After you have gone through all these steps, you are ready to tackle your company's documentation problems. You have also become an experienced systems documentarian, and you are ready to move on to a company that pays better. IBM and Digital Equipment will go up to $30,000 for a good writer these days.

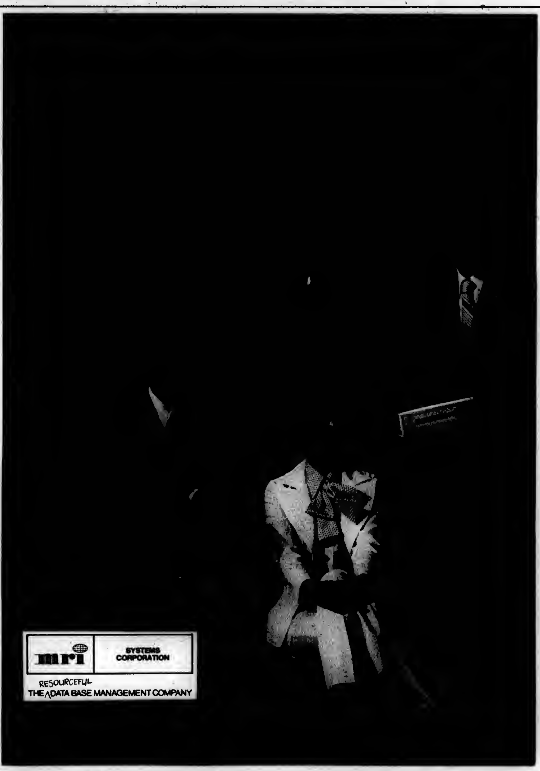
If, however, you decide to stay where you are, there are only two things to do.

The first is to forget all the generalized good advice that I have just given. You don't have time for it.

The second thing is to find an interesting system and start churning out the paper. In no time, you will have six people working for you, and you will be able to give them much better guidance than you ever received.

Rigo is president of Sysdoc, Inc. in New York City.

The Human Connection



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COMMUNICATIONS

Data Briefs

MFE Buffered Terminal Based on Intel Micro

SALEM, N.H. – MFE Corp. has introduced the Model 5000 buffered tape cassette terminal, built around the firm's earlier Model 250B tape cassette transport system.

Buffering, editing and communications in the Model 5000 are done by an Intel 8080A microprocessor.

Programmed high-speed search and edit functions, as well as communications capability, are standard features.

The Model 5000 is said to conform to Ansi Ecma standards with tape speeds of up to 120 in./sec on cassettes capable of holding 175,000 characters of formatted data.

The system utilizes read-after-write for error detection and employs data correction routines, the company said.

The Model 5000 costs $1,995 with delivery in 30 to 45 days from MFE at Keewaydin Drive, Salem, N.H. 03079.

Bedford Modex Includes Hytype II

BEDFORD, Mass. – Bedford Computer Systems, Inc. has introduced the System 75 Model X, a hard-copy data terminal utilizing the Diablo Hytype II 45 char./sec printer.

The terminal, which also incorporates an Intel 8080 microprocessor controller, operates as a desktop unit with a 96-element upper/lower case Ascii character set.

Standard features include advanced graphics, a buffer monitor allowing operation at 1,200 bit/sec, print enhancement, reverse printing and full format controls, the company said.

The Model X is priced at $3,395 with delivery in 45 days, the vendor said from 3 Preston Court, Bedford, Mass. 01730.

Digilog Enhances Telecomputer II

HORSHAM, Pa. – Digilog Systems, Inc. has an upper/lower case character set for its Telecomputer II CRT display terminal.

The Telecomputer II is a teletypewriter-compatible terminal that can use any size CRT monitor for its visual output and handles up to 10 monitors simultaneously, the company said.

The upper/lower case character set is available as an option for the basic $1,295 terminal for $250, it noted.

The terminal includes such features as switchable line length of 40 or 80 characters, switchable operation between half- and full-duplex modes and switch-selectable transmission rates of 50- to 9,600 bit/sec, according to a spokesman.

Digilog Systems can be reached at Babylon Road, Horsham, Pa. 19044.

Faced With Growing Number of Claims

Insurer Testing Large Terminal Net

By John P. Hebert
Of the CW Staff

HARTFORD, Conn. – Premeditation characterized a large insurance company's move to a computer-based communications network which should expand its claims-processing capabilities for medical and dental policyholders.

Aetna Life & Casualty here has installed 58 intelligent communications terminals on its way to bringing up 1,000 terminals in 40 branch offices throughout the country in the next 16 months.

Robert Gilligan, the officer in charge of the Aetna Computerized Claims System (Aecclaims), explained the reason for the system's implementation was to prepare for the possibility of national health insurance and to help with a workload that has been steadily growing in the last 10 years.

With the rising volume of dental coverage lately, the number of people processing the claims was rising, but with diminishing returns, he said.

With 4,000 employees already in Aetna field offices, the unit cost of processing each policy was increasing disproportionately. Coupled with a high turnover rate of field-office clerical employees, these factors left Aetna faced with "one of those problems you can't solve with more people," Gilligan said.

So, at the first signs of these growing pains three years ago, Aetna began developing Aecclaims.

40 Vendors Solicited

Proposals were solicited from over 40 terminal vendors, with 18 to 20 responding. When the field was narrowed to four vendors' machines, each was installed at Aetna's Civic Center pilot office here and tested for six months.

The pilot office now has about 60 Bunker Ramo Corp. (BR) Model 90/17 terminals and associated BR Model 90/97 printers operating at 120 char./sec.

About 150 man-years of effort have gone into Aecclaims, Gilligan said. The terminals are tied to the company's 4M-byte IBM 370/168 mainframe located at the headquarters office two miles away by leased Bell 4,800 bit/sec lines and Bell 208 data sets, according to Jack Abbruzzese, the insurer's telecommunications specialist.

Before entering the 370/168, the claims data passes through a BR Model 90/20 minicomputer communications controller and a Memorex Corp. 1270 telecommunications control unit, Abbruzzese said.

In the future, other branch offices will have 16 to 60 terminals installed depending on claim volume.

The new system will enable Aetna to hold the line on claims processing and turnaround time, in addition to maintaining nationwide uniformity in claims handling, Gilligan said.

"We're not the first major insurer to use a computer for group claims, but we feel Aecclaims gives us the most advanced system of its type in the industry," according to William W. Waters, vice-president of the Life and Health Claims Division.

Aecclaims can not only process both medical and dental claims but, because it is tied into existing computer systems, it "gives us single-computer access to the benefit provisions of each of our policyholders, the claim files of each covered employee and the data on current charges for medical and dental services," Waters said.

"Most of the systems we are aware of require separate computer operations to get this same data and also require a good deal of manual support," he added.

Almost a Personal Letter

Changes in the Aecclaims data bank can be readily made and individual employee files are automatically updated in the regular claim payment procedure. In addition to eliminating computation errors, Aecclaims offers a new method of explaining to claimants how their payment was determined, Waters said.

"We call it an "Explanation of Benefits" form, but it is about as close to a personal letter as a computer is capable of producing," he explained.

Through the terminals, the field office submits the claim data and learns in seconds the amount of payment. Aecclaims then prepares and mails the claim draft and Explanation of Benefits form, updates its records and mails microfiche copies of the entire transaction to the local office.

Each office will be equipped with several data terminals, each with its own keyboard and CRT screen and one printer. When a claim is presented, the terminal will be used to retrieve the family's previous claim history from Aetna's computer, and the information will be immediately displayed on the screen.

Abbruzzese would like to eventually see his firm adopt Bell's Dataphone Digital Service (DDS) capability to achieve better performance and data checks.

And, in the future, Aetna will probably go to integrated service for Aecclaims and its separate Life and Casualty networks, which support 200 terminals and 450 terminals respectively, he said, adding he is waiting for IBM's Synchronous Data Link Control protocol.

"There would be tremendous cost savings with consolidation," Abbruzzese said.

Infotron, Timeplex Gain Honors In User Survey on Multiplexers

By John P. Hebert
Of the CW Staff

DELRAN, N.J. – Infotron Systems and Timeplex, Inc. units gained perfect scores for both overall performance and hardware reliability in a recent survey on multiplexers conducted by Datapro Research Corp.

Despite the large estimated size of the installed base of such equipment, Datapro received only 33 usable responses. In its report of the survey results, "All About Data Communications Multiplexers," the research company conjectured the reason for this was that the survey didn't "reach the personnel responsible for handling multiplexers," and not that there are few units in use or that readers didn't bother to reply.

Users who did respond to the survey rated the devices on a scale from 1 to 4, with 1 representing "poor" and 4 representing "excellent." Datapro assigned weighted averages to these ratings in each of five categories – overall performance, hardware reliability, maintenance service, ease of installation and ease of expansion.

Users gave the Infotron time-division multiplexers (TDM) and the Timeplex T-4 TDM marks of 4.0. The Timeplex T-20 was rated 3.8 by four users of 19 units.

In the area of hardware reliability, the Infotron 240 and other Infotron multiplexers gathered ratings of 4.0, as did the Timplex T-4 TDM.

Runners-up in the reliability category included GTE/Lenkurt's frequency division multiplexer (FDM) with a score of 3.7 and other units in the Timeplex series of TDMs.

The Infotron 240 gained the highest marks from users in the remaining categories of maintenance service, installation ease and expansion ease, with marks of 3.8, 4.0 and 4.0 respectively, the report said.

Codex Corp.'s 900 series TDM received the second highest grade in the area of maintenance with a 3.6 rating. It was closely followed by the Timeplex T-4, which was given a 3.5 score from two users with three units installed.

(Continued on Page 23)

A new Recorder to talk about

We'd like to introduce you to our great new cassette data recorder, the AJ 730. You can use the AJ 730 off-line to edit or store information, on-line to communicate to remote computers or terminals, or in a network of data communication devices including other AJ 730's.

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For Dispatch and Monitoring

Auto Club Speeds Services With Mini-Based System

ST. LOUIS – Emergency road service at an auto club's communications center here has reportedly become more efficient with the help of a minicomputer-based communications terminal dispatch and monitoring system.

The Computer-Aided Support for Emergency Road Service (Casers) system was conceptualized by the Auto Club of Missouri and developed by the club and a St. Louis-based consulting firm, according to a spokesman.

As far as the club can determine, it is the first and currently the only computerized dispatching/monitoring system for emergency road service, he said.

The club considers the system to be "an optimum combination of automated processing and human judgment" and plans are under way to implement it in the club's Kansas City communications center, the spokesman stated.

Casers is based on a Texas Instrument (TI) 980 minicomputer with 64K bytes of 18-bit main storage equipped with a specially modified DX980 operating system and special applications software, he said.

Terminal Transactions

Peripherals consist of a 2.28M-byte Diablo Corp. Model 31 disk for loading at the center here; a TI-built industry-compatible 45 in./sec tape unit and a 320 char./sec Centronics Data Computer Corp. matrix printer.

A constellation of 29 TI Series 91L CRT terminals are also located at the office here, he added.

Incoming calls are routed automatically to one of a group of service counselors, each of whom has a 91L CRT terminal for data entry.

Information about the service requests including members' names, phone numbers and description and location of their automobile is logged on an automatically displayed form template in any order, he said.

Upon transmission to the processor, the request is assigned an identification number, an entry time and a geographic zone designation based on the telephone number.

The information then moves to a spotter, whose CRT display is supplemented by a list of garages operating in the zone assigned to that service request.

By looking at the current loadings for these garages (also part of the CRT display), the spotter selects an appropriate garage, assigns the call to one of the dispatchers and releases the service request for further processing.

This sends the information to the terminal of the designated dispatcher and brings the next service request to the spotter's terminal.

The dispatcher exercises his prerogative to change or accept the assigned garage, radios the appropriate garage to dispatch the service request and releases the information to the processor, the spokesman noted.

When a garage reports the disposition of a service request to a dispatcher, he preempts the normal display on his CRT terminal, retrieves the information about the affected service request and logs the additional data.

Once this is done, the regular dispatching cycle resumes automatically, he said.

Supporting these functional units is a supervisor's CRT equipped with a wide variety of commands for monitoring all aspects of system status and performance, generating immediate summaries of system activity and modifying system operation.

Tracing Capability

One of the most effective features of Casers is its tracing capability, the spokesman noted.

When a member calls back to determine the status of his service request, the person receiving the call – probably not the same one who logged the original request – can retrieve complete information about that request merely by specifying the first two letters of the caller's last name.

In response, the system displays sufficient information about all requests with names having the same initial letters so the desired record is easily identified and retrieved.

The resulting display includes current status as well as the time for each status change, thereby allowing a full report to be given once the tracing process is completed. At that time, the CRT reverts to its regular data entry function, he added.

Supporting Features

This basic cycle of activities is supplemented by an array of supporting features.

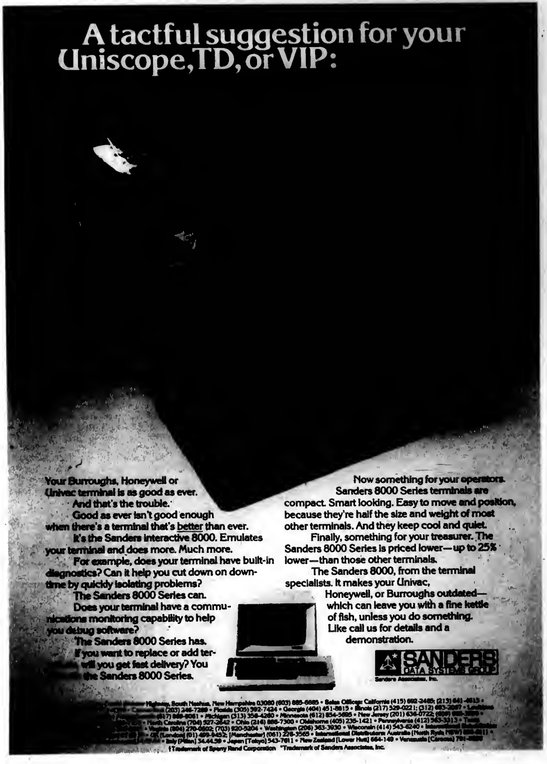
All information, including status changes, is maintained in a disk-resident file of request records and is paralleled by a printed copy, thus ensuring continued service without loss of information in case of system failure.

This was exploited one time in slightly over a year of basically continuous online operation, he noted.

In addition, at the end of each day, the system produces on magnetic tape a complete archive of the day's activities. This is transferred to microfiche for subsequent reference and follow-up work.

During the operating day, a variety of procedural conveniences function automatically on command. For example, if a service request has not undergone a status change within a prescribed time interval, that record is displayed automatically on the appropriate terminal, interrupting the normal processing/display cycle, he said.

Similarly, such interruptions may be instigated directly from the CRT in order to handle some special processing.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Codex Control System Handles Fast-Poll Modem Diagnostics

NEWTON, Mass. – Codex Corp. has introduced the Multipoint Network Control System (MNCS) which provides monitoring, diagnostic and restoral functions for Codex's Fast-Poll multipoint modems.

The MNCS is composed of two basic elements: the master control console, which provides the man-machine interface to the multipoint network, and the remote card set, an option to the Fast-Poll modems.

The master control console is capable of providing control of up to eight separate multipoint lines, each of which can have up to 30 drops for a total of 240 addressable locations, Codex said.

Supplemental Control Capability

In addition, the system can be supplemented with digital patching modules which permit patching the console into an unlimited number of additional multipoint networks, the company noted.

The MNCS identifies that portion of the network which is malfunctioning and provides the capability for restoring network operation through alternate facilities, Codex claimed.

It operates through the use of a frequency division multiplexed secondary channel so many of the MNCS functions can be performed without interruption of data on the high-speed channel, it said, adding all operations and controls are performed at the central site and no manual intervention is required at the remote multipoint drop locations.

Three Operating Modes

Three operating modes are included in the MNCS: monitor, test and configuration. In the monitor mode, the EIA interface signals and modem indicators for all remote units can be determined successively or on a selective basis.

In the test mode, tha MNCS provides the capability to perform five system test functions which include placing all remote modems in the self-test modem check mode; doing an outbound bit error rate test to check the outgoing lines; placing any unit in an audio loopback mode; placing any unit in a digital loopback mode; and performing a poll test which simulates the dynamic operating modes of a multipoint network.

The configuration mode allows reconfiguration of the network from the central site using alternate facilities, such as the dial network or standby spare modems, to maintain network operation despite failures, the company said.

MNCS Options

Options to the MNCS include a dial backup auto answer unit, which switches a remote modem automatically into a dial backup mode upon receipt of incoming dial calls; a modem substitution switch, which switches a standby modem into operation under MNCS control; and the node bypass switch, which provides operation of MNCS functions at remote locations.

Pricing for the MNCS master control console is $4,950. The remote card set option is priced at $895, the company said.

Quantity discounts are available and delivery for all items is 30 to 45 days, Codex said from 15 Riverdale Ave., Newton, Mass. 02195.

Dual-Purpose Interface Bows

BETHEL, Conn. – A coaxial cable interface unit has been introduced by Computrol Corp. for computer-to-computer and computer-to-peripheral communications at transmission rates up to 1M bit/sec.

Two or more computers can be connected to one CCI-4000 coaxial cable, Computrol said. Computer-to-peripheral connections can also be provided with the CCI-4000 by the addition of plug-in peripheral point boards, it added.

Peripherals may be intermixed and operated at different speeds.

Transmission distance can be up to 40,000 feet without repeaters. High normal mode voltages, which may exist on the cable when transmitting over long distances, do not affect data transmission, Computrol claimed.

The CCI-4000 transmits data asynchronously in half-duplex mode, although full-duplex moda can be obtained by using twin cables and two additional cards in each CCI-4000, it noted.

The standard CCI-4000 employs a parallel interface designed for standard I/O boards of most computer manufacturers. A CCI-4000 is used to connect each computer to the cable, according to the company.

The CCI-4000 includes coaxial cable modem and logic interface cards and power supply.

It is priced at $2,840 with a 120-day delivery schedule, Computrol said from Berkshire Industrial Park, Bethel, Conn. 06801.

Infotron, Timeplex Gain Honors

(Continued from Page 21)

GTE's FDM received a 3.7 in the ease of installation category; for ease of expansion, the notables were Timeplex's T-4 and T-20 devices, which each received 3.5 ratings.

Some users have more than one type of multiplexer, so the replies represented a total of 46 product ratings; a total of 220 units were reported on, Datapro noted.

About one-third of the users surveyed use the public telephone network's dial-up facilities and about two-thirds use leased lines to establish the low-speed side connections, according to the research firm.

On the output side, 25 responses indicated usage of a leased voice-grade line without identifying a carrier; six users named Bell's Dataphone Digital Service (DDS) network; one user named the now-defunct Data Transmission Co. (Datran) service; and two named Western Union.

A majority of TDM users are employing 4,800 bit/sec lines (31%) and 9,600 bit/sec lines (29%).

Common Problems

The most common problems outlined by respondents were line outages or line quality, gathering 39% of the responses, the report showed.

The survey report contains comparison charts on 46 multiplexers offered by vendors, noting the technique used (TDM or FDM); interface, code and speed intermix types; diagnostic facilities; and pricing and availability.

"All About Data Communications Multiplexers" costs $10 from Datapro at 1805 Underwood Blvd., Delran, N.J. 08075.

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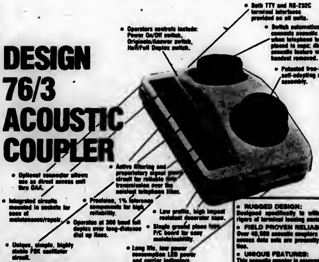
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Bits & Pieces

Edmac Key-to-Tape System Features Buffered Keyboard

EAST ROCHESTER, N.Y. – Edmac Associates' key-to-tape system features a buffered keyboard on a data entry terminal and cassette tape recorders.

Up to 11 characters may be entered on the keyboard; each entry is displayed prior to recording to permit verification, the firm said.

Data is recorded on cassettes in Ascii format, and up to 90,000 characters can be recorded on each cassette. The system sells for under $1,000.

While as many keyboards and cassette recorders can be added to an installation as a user needs, one playback unit can often serve them all, the vendor noted. That unit connects on-line to a dedicated mainframe, a time-shared system, a programmable calculator or a modem. It is priced at $2,350.

Both the key-to-tape system and the playback unit are available from Edmac at 333 W. Commercial St., East Rochester, N.Y. 14445.

Dysan Has Top-Loading Cartridge

SANTA CLARA, Calif. – Top-loading disk cartridges in an IBM-compatible configuration are available from Dysan Corp.

The Dysan 5440 cartridges also come in non IBM-compatible configurations, meaning they have one index and a variety of sector slots as opposed to one index with no sector slots, the vendor said.

With capacities of 2.5M bytes to 4M bytes, the cartridges are $98 each and can be obtained from the firm at 2388 Walsh Ave., Santa Clara, Calif. 95050.

Burster Has Variable Speed Control

OAKLAND, Calif. – Tion Equipment Co. has introduced a forms burster with a variable speed control feature said to allow an operator to perform a variety of functions in one operation.

The burster has a decollate feature, slit pin-feed margins and a chop margin waste option as well as an imprinting option.

Operating at over 300 ft/min, the system includes two jam detectors, dynamic breaking, a static eliminator, rollers designed to reduce carbon tracking, safety covers, adjustable tear points and a center slitter, he said.

The standard burster is priced at $3,040, the imprinter costs $450 and the chopper costs $210. Tion is located at 262 Grand Ave., Oakland, Calif. 94610.

Earnings Quadruple Since '68

System Keeps Pace With Firm's Growth

BIRMINGHAM, Ala. – Faced with unprecedented growth over the last several years, a company here has updated its DP department with an information system it hopes will match its growth pace, according to Ray Parrish, DP manager.

Alabama By-Products Co. (ABC) has quadrupled its earnings since 1968 and employment has risen from 1,000 to 2,900 people. The company was recently thrust into the ranks of *Fortune's* Second 500.

But ABC's DP department was outdated. Operating essentially with bookkeeping machines, the firm was able to handle accounting applications, but was unable to take on additional tasks, Parrish said.

"We were just running out of steam with these machines; what we were looking for was a lot more power and capability, particularly in communications," he recalled.

The firm considered systems from IBM, Burroughs Corp., Honeywell Information Systems and Univac before choosing a Univac 90/30.

"By comparing the cost of the systems through the growth cycle, the Univac seemed to be lower in the long range," Parrish noted.

The 90/30's performance, based on a comparison of the other systems' internal power ratings, was about one and one half times greater, he added.

The company was considering small-scale models of the other companies' systems, but none offered a growth path compatible with ABC's needs, he added.

"At the time, we could have gotten 16 100M-byte disk packs for the system; now Univac offers double density, so we can even go to 16 200M packs," Parrish said.

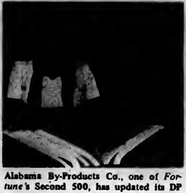
Another factor in the selection was the applications software, which was unbundled with most of the systems but still bundled on the Univac. That made a difference of about $1,000/mo, Parrish said.

ABC's Operations

ABC's oven plant at Tarrant City, Ala., produces about 800,000 tons of coke annually.

The company also operates six large underground coal mines in Alabama, the newest of which is expected to reach full capacity in late 1976, and one surface coal mine. Coal production was in excess of four million tons in 1975.

ABC's payroll DP operation encompasses three main payrolls – a biweekly covering 2,300 miners, a weekly for 400 employees at the Tarrant plant and a monthly for salaried personnel.



Alabama By-Products Co., one of *Fortune's* Second 500, has updated its DP operations.

The payroll operation is a complicated application, Parrish said, explaining the computer runs 11 different payrolls – each unique to a particular facility.

"We have to cope with just about every type of situation that can be encountered in a payroll," Parrish said. "For example, our miners could be working under five or six rates of pay in one day."

Time abstracts for the miners and plant employees are received in the DP department, keypunched and then entered into the system. In the near future, ABC hopes to reduce much of the paperwork involved in this operation by transmitting pertinent information from the mines and plant directly into the system via remote key-to-disk or key-to-tape terminals, according to Parrish.

Another of ABC's plans is to "marry" the personnel data base to the payroll, he noted.

"We will have work-history records on which we can capture information on any changes and obtain data on an employee's new status immediately after he is transferred from one workstation to another," Parrish said.

Information in the personnel data base will be accessed by keying in either the employee's Social Security, payroll or employee number.

ABC will use Univac's IMS/90 software to facilitate retrieval and updating of information in the personnel data base.

Soon, the firm plans to install terminals for authorized personnel department staff to access information in the computer's data base, Parrish said.

One section of the personnel data base will be reserved for storing information on persons applying for employment.

When a change occurs in an employee's status or other data, the personnel data base will be updated and a "flag" will be set. A listing of all new changes will be made and a master sheet prepared for the personnel department on a monthly basis, he said.

The computer will also produce individual employee record forms which can be run weekly or monthly as needed on an exception basis to reflect changes in the employee's data since the last run.

The present preventive maintenance program will be expanded into a full maintenance reporting system covering the company's mines as well as the plant.

Presently, work order schedules are produced by the computer weekly for various departments at the Tarrant City plant. These schedules are produced on the computer immediately prior to the week when the work is scheduled, Parrish noted.

Executives See Tie Between DP, Profitability Getting Stronger

CHICAGO – DP and financial executives believe data processing will be more important to their organizations' profitability in the next five years than ever before, according to a survey conducted by Peat, Marwick, Mitchell & Co.

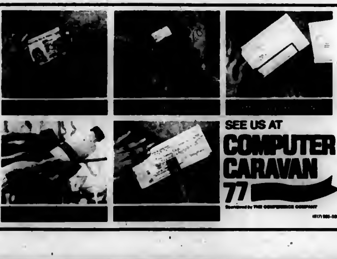
But the more than 147 corporate presidents, financial vice-presidents, controllers and heads of DP departments surveyed indicated their data center users are not satisfied with present service levels.

One out of four of the executives said they have attempted to measure the return of their DP investment, but fewer than one out of three are satisfied with that return.

Only 30% of the survey participants said top management rates the performance of their organizations' data centers on quantified measures of performance. This could be changing, however, since more than one-third indicated their organizations have a plan to improve data center performance, the survey noted.

About half have some form of computer performance evaluation (CPE) effort planned or under way, the survey found. About one-quarter of the participants said their computer vendors encouraged them to establish a continuing CPE effort.

The survey was conducted at a seminar sponsored by Peat, Marwick, Mitchell's Chicago office. Organizations represented were financial institutions, manufacturers, government and nonprofit groups. The firm can be reached at 222 South Riverside Plaza, Chicago, Ill. 60606.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DATA ENTRY STATIONS VENDOR MODEL
INTERESTED IN: ☐ ALPHA NUMERIC
☐ NUMERIC ☐ HAND PRINT ☐ OTHER
SPECIFIC FONTS ____________
☐ TYPEWRITER ☐ PRINTER ☐ EMBOSSER

[illegible] information systems, you'll make [illegible]

Your company's data processing requirements are as unique as your company's trademark. You need an information system designed exclusively for you—not for the other firm. This means a wide range of high performance products to select from, a knowledgeable staff of representatives to make the ideal recommendations. There must be value, versatility, and the finest service. That means Mohawk Data Sciences. In data entry and data communication equipment, we help you make the Intelligent Choice.

Every MDS product is designed to be the best of its kind. Our equipment is engineered to maximize support capabilities (and manpower capabilities) while minimizing mainframe work load. The MDS Intelligent System, a prime force in distributed data processing, makes [illegible] ods for the p[illegible] tion of informatio[illegible] technological re[illegible] MDS [illegible] unparalleled scope of data systems to major corporations around the world.

Post-installation service must be a consideration of any company evaluating new equipment. MDS is synonymous with the highest standards of product service. Our 4000 plus associates worldwide insure that the highest caliber of performance is built into our equipment—the performance you can depend on in your offices.

Solid business solutions can emerge only from facts. Hard-hitting, solution-oriented facts—precisely what you'll receive from your local MDS office. Call or write us soon. We make the Intelligent Choice an easy one.

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MDS System 2300. The System 2300 is an intelligent terminal offering computer-compatible data capture, simultaneous with Document Processing at the source. The 2300 is also capable of RJE Communications.

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MDS INTERNATIONAL SERVICE CORP.
Rue Ducale 53
1000 Brussels, Belgium
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Intel Has Add-On for PDP-11/70

SUNNYVALE, Calif. – The In-1670 from Intel Memory Systems offers 4M bytes of add-on memory for the Digital Equipment Corp. PDP-11/70 in the same space required by that system's own memory, Intel said.

A complete system with memory cards, chassis, power supply, cooling fans and controller can be installed directly into the PDP-11/70 memory cabinet without modification, the firm said.

The memory includes error-correction checking and error-logging features and is said to correct all single-bit failures. Double-bit failures are recorded in hardware registera for later examination during maintenance service, Intel said.

All voltages, currents, timing and I/O signals are 11/70-compatible, the vendor claimed. The memory can be expanded in increments of 128K bytes and features a 750 nsec cycle time with a 550 nsec access time, the firm noted.

The cost of 128K bytes of memory is $13,000; 1M byte costs $52,500. Intel is at 1302 North Mathilda Ave., Sunnyvale, Calif. 94086.

$1 Million Inventory Cut Credited to Minicomputer

By Esther Surden
Of the CW Staff

ALLENTOWN, Wis. – A minicomputer credited with reducing inventory by $1 million since its installation has been keeping tabs on everything from customer order entry to shipping, the user said.

Maysteel Corp. is a sheet metal fabricator specializing in close-tolerance custom cabinetry for automatic data systems, appliances and office equipment. It processes approximately 1,000 jobs at one time in its plant here.

Each job has an average of 10 component parts and six operations per component, totaling about 10,000 components requiring materials costing and 60,000 operations requiring labor and overhead costing.

When the firm decided it needed to computerize, it investigated time-sharing with another firm in the same business. After it got started and established an implementation team to define what it wanted to do, however, "we decided that trying to time-share with another company was never going to be sufficient for us," according to Lewis Eytchison, vice-president of materials and information system.

At that time the company looked at both Honeywell and IBM systems. The Honeywell system was not installed in any working applications, and the firm's consultants, former IBM people, informed the company that conversion to a Honeywell system would be expensive and take more time than conversion to IBM, Eytchison said. The company then purchased an IBM 3/10.

The company has since upgraded in a variety of steps to a 3/15 with 256K and then 180M bytes of storage. Cardless for about a year, the firm will soon upgrade to 5M bytes of storage, Eytchison said.

The configuration at Maysteel includes the Model 15 with three printers and eight CRTs, two of which are remotely located, and IBM 3741 diskette recorders, he said.

The system, including hardware, software, consulting fees and employees' salaries, has cost the firm over $500,000 over the past four years, he added.

Well Defined System

The reason the firm's system works as well as it does is because the data base is clearly defined, he said. This he credited to the consultants who did the major programming for the system, MRM, Inc., a Milwaukee firm.

Maysteel's data bsse covers information on almost every aspect of the firm's business. Customer information includes sales orders, purchase orders, customer parts numbers and the master schedule.

Information on the manufacturing process includes an engineering part master, bill of materials, routing, work center program, tool bill and tool master, as well as manufscturing orders and open purchase orders.

The system also keeps track of component materials requirements, labor in

(Continued on Page 32)

Processing Time Slashed

Warehouser Likes the Way Mini Stores Orders

LOS ANGELES – A minicomputer system at a public warehouse firm here has cut order-processing time from several hours to less than 10 minutes and increased billing accuracy with a resulting improved cash flow, the user said.

U.S. Growers Cold Storage's customers are primarily food brokers who order various commodities in volume and store them in public warehouses. When the brokers receive orders from restaurants, fast-food chains and other retail outlets, they phone U.S. Growers and specify product, quantity and delivery information.

The firm's revenue stems from warehouse charges, handling and special processing, according to Jerry Monroe, the firm's DP manager.

Clerks record 400 to 500 types of incoming inventory each week, storing lot number, quantity and location on disks attached to a Digital Equipment Corp. Datasystem 500. The system keeps records of the more than 10,000 pallets of commodities stored by 500 active customers.

Records Once Outdated

Before U.S. Growers installed the mini system, inventory, accounting snd order processing were bssically manual operations supported by an outside service bureau. Records and receiving documents were batched and transmitted daily using a remote job entry system.

The service produced lot listings and sent them by messenger to U.S. Growers. Because of the time involved, the records were one to three days out of date.

Incoming orders were manually checked against monthly, weekly and daily listings before preparing the shipping documents and sending them to the warehouse for delivery.

The Datasystem 500 configuration consists of a PDP-11/45 CPU with 80K words of core memory, one RP04 disk, s TU16 tape drive and a 1,200 line/min printer. Input is through six on-line CRT terminals with printing terminals providing hard-copy output for each of the five warehouses.

All application software was written in Basic Plus and operates under DEC's CTS-500 commercial transaction executive.

U.S. Growers examined a number of on-line systems including those from Basic/Four Corp., DEC, General Automation, IBM, NCR, Singer and Qantel. After about a year of analysis, it finally decided upon the DEC Datssystem 500.

The alternatives were ruled out one by one, Monroe noted. IBM and NCR were eliminated from consideration because their prices were sbout $150,000 more than the company wanted to spend, he said.

Qantel's system didn't seem to have the necessary capabilities and the Basic/Four unit could only support four terminals; General Automation was "just coming out with the necessary software, and we didn't want to be a guinea pig"; and Singer was on its way out of business.

Operating since last October, the system has cleared up ambiguities inherent in the previous batch method. Clerks process telephone orders directly using on-line CRT terminals. When a broker calls, a clerk keys in a lot code number, quantity and delivery information.

The system immediately compares the order with the broker's stock listings resident on disk and confirms the quantity can be shipped.

In the past, Monroe said, there was a high likelihood the clerk would miss an entry in the five books of listings or the individual daily receiving and shipping tickets. Now, if the broker orders 55 cases from a lot containing 50 cases, the program prevents the order from being sent to the warehouse and informs the clerk.

(Continued on Page 32)

U.S. Growers' order entry center handles 300 ordera per day.

Tap us for terminals.
There's one for every need.

GE TermiNet 30* — 30 cps
Mag tape send-receive metrix printer. Speed and flexibility on e day-to-day basis. ($90-$145 per month,depending on model selected, on a 1-yr. leese, including maintenance.)

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Model 33ASR with dial-up set. ($90 per month on a 1-year leese, including maintenence.)

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A lot more electronic, e lot less mechanicel and smaller than other teleprinter equipment. Aveilable ribbon or ribbonless. Dependable with day-to-day reliability. ($59 per month on 1 yr. lease, including maintenance.)

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First we track down the problem.

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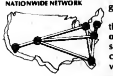
Four problem-solving options are yours with Martin Marietta Data Systems' On-Site Remote Job Entry Computing Service.

1. RJE ... as a **Supplement** to current facilities

Through our Nationwide Network, you can supplement your existing computer by plugging into the **virtually limitless configuration**, infinite capacity and state-of-the-art technology of our 370/168's. Simply install a Remote Job Entry Terminal in your offices—or those of a remote subsidiary—and the power of the /168's (16 meg with VS, TSO, IMS, CRJE) is immediately available.

You'll save money compared with upgrading or replacing your existing machines—especially if it's well written down. **You pay** *only* **for what is used**; avoiding the quantum "step" costs associated with upgrades. Your loads can grow until upgrades are fully justifiable.

NATIONWIDE NETWORK



On our Nationwide Network (as with the central hardware and software) **economies of scale and utilization apply** offering substantial savings on the cost of communication equipment, associated central software and attendant network management.

eg: Network Management Supplements Capacity

PROBLEM: "We need to service a remote location, but we must carefully evaluate the costs and support required to enhance our existing facilities. What are our options?"

SOLUTION: This massive oil company with twin IBM 370/168 processors (with plenty of computing power left) in a centralized environment is now servicing a remote location through MMDS' **Networked RJE Computing Power**. An imaginative approach from MMDS proved more cost effective than expanding their existing communications network.

By leasing one shift of an existing terminal facility, they received immediate benefits:

Testing	Shakedown of terminals, lines and modems not required
Reliability	Redundancy (routing/lines) already built into MMDS' Network. Cost prohibitive if on their own.
Timeliness	Conversion, security procedures and systems set-up by MMDS' specialists—per requirements.

Had they expanded their existing network, they would have absorbed 100% of the following costs:

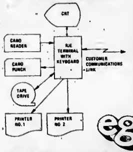
Terminal	$1,886/month
Dedicated Line	1,760/month
Modems	500/month

While spending only a third of the dollars they, more importantly, share in the economies of scale and utilization of the MMDS Network. Elimination of associated network management tasks was more than welcome.

2. RJE ... as a **Replacement** for an existing facility

Using MMDS's Remote Job Entry Computing Power is **as convenient as running your own machine**. It's cheaper (10%–30% typically) and more versatile. Responsive to either growth or reduction in usage, you always work at 100% utilization: paying only for what is used.

EXAMPLE: RJE CONFIGURATION



On-site card readers, video terminals and printers are handled the same as those on an in-house computer. You test programs and run your systems exactly as on your own machine. **Operational control is unchanged**, except that mainframe tasks are handled by the MMDS "Host" Computing Center. Because of this difference you get: contemporary hardware/software, networked computing power, daily configuration flexibility and free access to MMDS' methodologies and tools.

eg: Manufacturer Replaces 370/135

PROBLEM: "Our remote locations need information distributed on a more timely basis. What additional hardware (local and remote), software and technical capability should we add? What are the costs?"

SOLUTION: Without increasing costs, this medium sized DOS user immediately satisfied his total requirements. He's now utilizing the latest in hardware and software without having incurred the in-house expense associated with implementing such enhancements. Tapping MMDS's **expertise in mini-computers and communications networking**, he installed a distributive data processing network. This distributive network allows placement of critical information at remote sites in a matter of minutes, not days.

MMDS's Networked RJE Computing Power is compared with this user's prior costs. Included are the costs of their distributive network—a Datapoint 2200 and two 1100s. With no change in overall costs, he's expanded his service and added new systems: he's using our off-the-shelf Modular Application Systems (MAS)—free through RJE.

	BEFORE MMDS	WITH MMDS	$ SAVINGS
Hardware*	$19,000/Mo.	$ 1,050/Mo	$17,950/Mo
Personnel	10,000	7,300	2,700
Supplies	2,500	2,200	300
Miscellaneous	550	120	430
Processing	-0-	14,000	(14,000)
Communications	-0-	600	(600)
New Hardware**	-0-	3,000	(3,000)
TOTAL	$32,050/Mo	$28,270/Mo	$ 3,780/Mo.

*In-house computer and related unit record equipment
**Terminals and minis

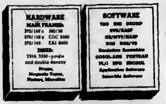
3. RJE . . . as an **Alternative** to acquiring a new computer

Instead of installing a small computer, consider **RJE Terminal Computing as an alternative**. You get your own card reader, printer and video displays; and you **use the terminal as you would your own machine.**

There the similarity ends. You avoid all the constraints of small computers: gaining speed, facilities, capacity, programming languages, off-the-shelf system libraries and flexibility. **You keep your options open**; while escaping the tyranny of machine amortization and the forcing of systems and installation schedules.

Above all, from MMDS, you get business systems expertise and data processing discipline. With no cost for our *Systems Development Methodology* and free systems and programming tools, we pass on the *attitudes* and *disciplines* of successful computer/systems usage.

CAPABILITIES SNAPSHOT



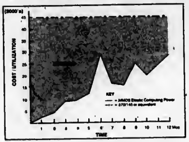
eg: State Agency Saves 50% in One Year

Problem: "Budget is not our problem! To implement our new system, we must accurately predict the eventual computer power and utilization requirements . . . as well, growth rate."

Solution: To implement their sophisticated "Road Design System," the agency considered acquisition of its own computer. A 370/145, or equivalent, was their best estimate. At $45K/month, all up cost, this would likely suffice for 2–3 years. At the same time, they recognized:

- in the short term, they'd have an under utilized machine (but continued upgrade would be a headache);
- a missed projection could be an expensive error.

MMDS is now supplying them **"elastic" computing power through an RJE Terminal**. In one year, RJE Computing Power helped them build experience with their system, determine their level of utilization and save over $300K, plus associated opportunity costs.



If the agency should elect to go to an in-house computer, its risks are now minimized.

. . . and the Technology to Support You

Using MMDS' RJE Computing Power gives you facilities, software and flexibility. Running the terminal is almost exactly like running your own machine. But the data processing expertise and disciplines that round out the package provide further payoffs. For example:

FREELY AVAILABLE TOOLS

- Systems Development Methodology (SDM)
- Data Specification Language (HSL)
- Decision Table Processor (Tablemaster)
- Modular Programming Test Harness (Testmaster)
- Off-the-shelf Modular Application Systems (MAS)
- Modular In-House Training System (MITS)

Productivity Aids

With over 50 technical specialists and large-scale equipment, we provide a complex VS, TSO, IMS, CRJE environment. This, with the compilers and utilities we offer, gives you a lot of power. We make sure that the system is fully up-to-date and exercised. On top of that, we make available—at no cost—our proprietary **methodology and tools**.

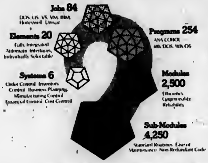
MMDS Conversion Program

Operating as TSO commands, these programs produce a mixed conversion to OS and/or DOS simulation under OS—from DOS or other operating systems. The accompanying chart shows the conversion strategy used by these programs as a function of original program type:

ORIGINAL SYSTEM	METHOD OF CONVERSION	RESULTING DS SYSTEM	PCT. OF JOB AUTOMATICALLY CONVERTIBLE
COBOL DOS/D	MMDS Conversion Programs	OS ANS COBOL	
ANS/DOS COBOL	MMDS Conversion Programs	DS ANS COBOL	
RPG I	MMDS Conversion Programs	DS RPG I	
RPG II DOS SYSTEM 3	DOS Simulator	DOS RPG II Under Simulator	
DBOMP	DOS Simulator	DOS DBOMP Under Simulator	
BOMP	DOS Simulator	DOS BOMP Under Simulator	
FORTRAN—Any	MMDS Conversion Programs	OS FORTRAN	
DOS ASSEMBLER	MMDS Conversion Programs	DS ASSEMBLER Under Simulator	
DOS JCL	MMDS Conversion Programs	OS JCL	

4. RJE . . . as a **Conduit** for off-the-shelf MAS

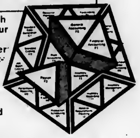
If you're concerned with systems as well as computer power, MAS through our RJE service provides access to over **340,000 lines of code at no cost**—with single supplier dedicated system convenience. You pay only for set-up and customizing you elect to have done.


Jobs 84
DOS, OS, VS, VM, IBM, Honeywell, Univac
Elements 20
Fully Integrated Automatic Interfaces, Individually Selectable
Systems 6
Order Control, Inventory Control, Business Planning, Manufacturing Control, Financial Control, Cost Control
Programs 254
ANS COBOL 40K DOS, 50K OS
Modules 2,500
Efficiency, Commonality, Reliability
Sub-Modules 4,250
Standard Routines, Ease of Maintenance, Non-Redundant Code

Our "Modular Application Systems" (MAS) are a range of business application modules. They can be run on your own computer, or on our nationwide computer power network (MAS on RJE). The distinctive structuring permits simple tailoring of the systems to your exact specification.

Use a module, a program, a job, a system or a selection of systems. Install them in any sequence, in a standard or customized form, and they'll link together to provide a completely integrated system that **fits you now and as your business needs** change.

eg: **MAS on RJE** Provides Immediate Financial Control

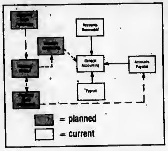


Problem: "We're projecting a 30% growth rate and need more timely processing of our financial data. We're also planning to add Inventory and customer and purchase order processing systems. What's our most effective approach?"

Solution: This high technology division of a major corporation ($8 million sales/200 employees) was relying on a conventional service bureau. They were restricted by couriers, mail service and inflexible software.

With **MAS on RJE**, they implemented in one action: Accounts Payable, Accounts Receivable, General Ledger and Payroll systems. And their general ledger was customized to accommodate Federal Government costing regulations. Their processing load (General Ledger/monthly, Accounts Receivable and Payable/weekly, Payroll/bi-weekly) has increased to over 50 jobs per month: but costs for processing have reduced from $4–5K/month to 2–3K/month

Assured of complete systems integration, they're now planning for implementation of MAS inventory and Order Processing systems, at their own pace.



For More Information: We like you to know about our products and services. Just return the coupon, or contact one of our regional managers, and we'll send you our Computing Services Handbook, effectively a manual for using our various RJE services. If it's easier, you might like to contact Dick Nemerson at MMDS Headquarters ((301) 823-1600; 300 East Joppa Road, Baltimore, Md. 21204). If your interest is in off-the-shelf MAS or our Systems and Programming services, we have equivalent handbooks. We look forward to hearing from you.

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NEW YORK: John Bately (212) 541-4740
BUFFALO: Milt Cooke (716) 634-8210
ORLANDO: Joe Putegnat (305) 855-1050
CLEVELAND: Chris Horrocks (216) 331-7755
CHICAGO: Chuck Erickson (312) 298-1247
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LOS ANGELES: Mike Strong (213) 328-0660
LONDON: Neville Cerfontyne 242-1951

Mail to: Dick Nemerson, MMDS Headquarters, 300 East Joppa Road, Baltimore, Maryland 21204

Please send me your handbook for:

RJE Computing Service ☐ **Systems & Programming Service** ☐
Off-The Shelf MAS Modules ☐

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Martin Marietta Data Systems

We Build & Run Systems

By Improving Inventory Control

Mini System Puts Dealer's Dollars in Right Products

BURBANK, Calif. – To make sure "the dollars on the shelf were in the right products at the right time," a distributor here switched from a manual office operation to a small business system.

"As distributors of both industrial and fluid power product lines, our two most important concerns are inventory control and sales performance," according to William Baribault, president of Elec Air Tool Co., Inc.

"In order to get the kinds of in-depth reports required to analyze the movement of products through the warehouse, as well as the necessary sales figures to determine profitability, we realized that computerizing was the best approach," he added.

Baribault spent two years looking at hardware and visited nearly 50 user sites with equipment from eight manufacturers before deciding on a Basic/Four Corp. system.

"Every computer installation that was successful had good preparation and documentation completed prior to the system's arrival. I saw good hardware that people were disillusioned with, but it was not the hardware's fault," he said.

Smooth Transition

Elec Air Tool made the transition to the Basic/Four system smoothly because the firm knew exactly what it wanted to do before it had the hardware on the floor, Baribault said.

"We reviewed the specifications over and over again and then went to a third party and had it design the software package," he explained.

"Everyone in our organization participated in developing the specifications for the system. This helped alleviate a lot of apprehension because our employees knew exactly what we were getting into.

"We felt it was very important that the people who had to deal with the system should have equipment that was responsive to their needs, rather than making our staff comply with the computer," he said.

In August 1974, Elec Air Tool installed a Model 400 consisting of a CPU, two disk drives, two CRTs for I/O and one medium-speed printer.

Operations Expanded

By October 1975, the firm's operation was expanded to include a northern California affiliate, so the company upgraded to a more powerful Model 600 with three CRTs and a faster printer. This represented an investment of about $100,000 in hardware and software.

"The success of the first model convinced us of the advantages to automation from an efficiency standpoint. Equally important, however, it showed an 11-month return on investment," Baribault said.

One of the system's major benefits is the capability to spot product trends, he noted. "For the first time, we can add products to our inventory when they are ready to sell. With our manual office operation, It was extremely difficult to identify new products that should be in inventory."

Benefits to Customers

The benefits of the system are spilling over to the customers with the help of a report Elec Air Tool developed for its customers that permits more efficient purchases. The report tells them what items they have been buying over a certain period, what the usage level has been by the month, how many times they bought a certain product and the latest unit cost.

Inventory Control

Inventory investment and control has also been improved. As an example, Baribault cited the case of one product that changed prices four times in 12 months.

"Keeping manufacturers' price books current in today's economy can be a real problem. But now, by using the mini the data is updated when a price change occurs. Then we can print out a new price list, so our sales force has the security of knowing it's selling at the proper price."

It was this kind of flexibility that caused Elec Air Tool to decide on the Basic/Four model.

(Continued on Page 34)

CDP REVIEW

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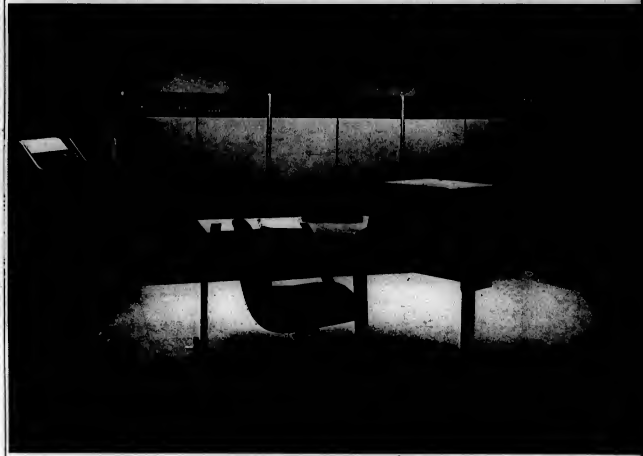

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And that means the company that came up with it had to have a lot of experience in both big and small computers. And there is only one company that does.

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To create a DECSYSTEM-20, we took the same approach to computing that's made us the number one company in minicomputers.

That approach says that a computer must first of all be affordable – giving you the most popular computer for the least amount of money.

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But, to create a DECSYSTEM-20, we also took the same approach to computing that's made us the leader in large-scale interactive systems for the last eleven years.

That approach says a computer should offer you the kind of powerful software that will give you not simply everything you expect in a big system, but everything you need.

With the DECSYSTEM-20 this

Real-Time System Pinpoints Manufacturing Problems

BALTIMORE – A time-shared, real-time minicomputer system is being used to locate the source of potential manufacturing problems at a Western Electric plant here.

The minicomputer system analyzes test results, performs trend analyses and correlates problems, singling out which particular raw materials, processes, personnel or specific equipment is the cause of an out-of-tolerance condition.

According to engineers at the Baltimore Works plant, the minicomputer also produces measures of overall shop efficiency.

"It provides a picture of production quality during a given period of tima and identifies problem sources. For example, we might discover, and quickly, that under certain conditions a particular problem is traceable to a particular machine line, a certain combination of operating conditions or even a particular materials supplier," a spokesman explained.

This plant is also using the mini to generate numerical control (NC) tapes used in testing telephone cords and loop distribution apparatus, evaluate the performance of production groups and perform general engineering analyses, such as simulating production processes to arrive at realistic wage incentives.

The plan processes four jobs on the system concurrently and as many as 10 users work with the minicomputer, a Hewlett-Packard (HP) 3000.

There ara 18 terminals located throughout the 168-acre plant site. All the terminals operate on a dial-up basis axcept two which are hard-wired to the system.

The Baltimore Works cable shop produces exchange cable and coaxial cable as well as smaller quantities of toll cabla and PVC stub cable.

In addition to the many process inspection tests that are performed during the various cable manufacturing operations, a number of tests are made on complete cables to ensure the cables meet exacting electrical specifications.

Most of these tests are performed on minicomputer-controlled test sets which produce hard-copy output and/or punched paper tape output. The punched paper tapes are then read into the HP 3000 as input to various programs which edit the data and store pertinent parts on magnetic tape files.

These magnetic tape files contain data on more than 10,000 individual cables and allow engineers to analyze the data.

Comparisons can be made for particular parameters between different types of cable or between different manufacturing processes.

System Produces Tapes

Another use of the system is in producing the NC punched paper tapes that contain the programmed instructions used for running tests of telephone cords. Test engineers have programmed the system in Basic, allowing technicians to enter cord specifications. The computer then generates the NC tapes on a 75 char./sec HP paper tape punch.

This tape is placed on a read-only memory controller that stores the test information into the test set. The operator then hangs up the cords, which may contain 100 to 400 wires, on a test rig, plugs them into the test set fittings and tests hundreds of different types, designs, colors and lengths of cord for continuity, correct sequencing and voltage breakdown.

DCT Has Desktop Units For Small Businesses

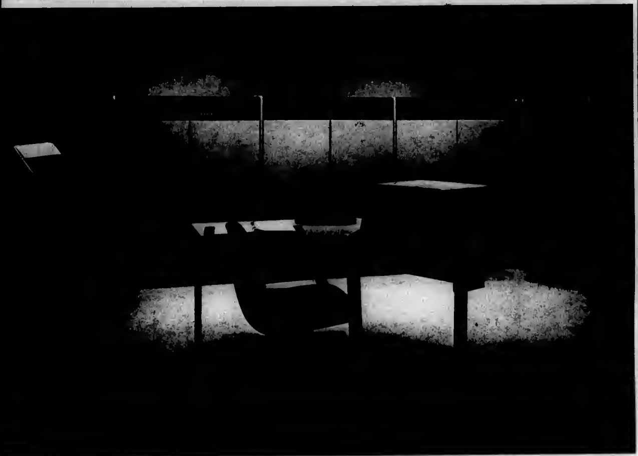
CAMPBELL, Calif. – Designed for small business users, the Micro File MK 11 and MK IV microprocessor-based desktop computer systems are stand-alone systems with floppy disk storage, according to the vendor, Data Terminals and Communications (DTC).

The MK 11 has one dual-disk drive while the MK IV handies two of the drives.

Each system has two RS-232 serial I/O ports that can handle both data terminal and other data communications lines operating at up to 9,600 bit/sec.

User memory is 8K bytes of random-access memory expandable to 56K bytes, the firm said.

The MK 11 costs $4,295 for a basic system while the MK IV costs $6,750, the company said from 1190 Dell Ave., Campbell, Calif. 95008.



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Mini Helps Vienna's Air Controllers Handle Traffic

VIENNA, Austria – A minicomputer here is helping this city's air controllers handle their congested flight docket. The system, operating around-the-clock, coordinates the air traffic control system.

The basic data for the Control Data Corp. System 17 is a file of repetitive flight plans, stored off-line and brought up for display at the commencement of a flight.

This information, often unchanged for several months, can be amended at any time by air traffic service messages. These include new flight plans, new arrival or departure times or other modifications to filed plans that are sent to the computer from outiying points in the Aeronautical Fixed Telecommunication Network.

System Checks Accuracy

Messages are prepared according to International Civil Aviation Organization standards and are checked for accuracy by the system as soon as they are received. Acceptable messages are processed immediately; those containing errors are routed to an editing and message correction display terminal. Changes are made and the messages are then returned to the mini for processing.

The Vienna air traffic control system uses CRT terminals as the dialogue units for all application-related transactions. A flight plan in the data base is activated when an "estimate" message is sent to the mini from a terminal.

This message projects the times at which an aircraft will fly over certain navigational aids, describes the flight plan route and includes the aircraft's current altitude and speed.

New information combined with data previously stored then enables the computer to prepare flight strips and flight-progress strips which are directed to the appropriate air control sectors.

As long as strips have not been printed, revisions to estimates can be made at any time by inserting new data at the CRT consoles.

In this way, air traffic controllers at the Vienna center can have immediately available the status of all flights under their jurisdiction as an aid in maintaining an orderly flow of traffic and preventing the possibility of aircraft collisions.

From there, local climatic conditions can be entered into the system via terminal as the computer calculates estimated flying times between reporting points.

In order to keep the "bays" of flight progress boards from being overloaded, flight strips are held in the system's memory until the air traffic controllers need them for coordinating aircraft patterns.

Mini Saves Warehouser's Time

(Continued from Page 27)

The clerk can then call up historical records of commodities in storage, receiving documents and previous shipments from various lots. With this data, the clerk can discuss discrepancies while the broker is on the telephone.

Once the quantities are verified, the program processes the order and prepares a picking slip which is remotely printed by a terminal in the appropriate warehouse. Time from order receipt to picking slip is less than 10 minutes, Monroe said. Once the lot is shipped, a confirmation notice is printed.

For even faster service, U.S. Growers has installed terminals in the offices of several large customers. The customers can enter their own orders and review their inventory status directly.

An important cost factor in warehousing is wooden pallets and separators. Boxed products arriving at the docks are placed on pallets using appropriate separators between each layer to ensure air convection for proper cooling.

These pallets and separators belong to U.S. Growers; the exact quantities are noted on the receiving tickets and become part of the lot record. If the pallets and separators are shipped with the lot and not returned within 30 days, they are automatically charged against the customer's account.

The value of this wood is significant in an operation of this size; $4,000 to $5,000 worth of pallets and separators cross the docks each week and "with the system we know precisely whose and where they are," Monroe said.

An essential part of the firm's changeover from the service bureau to in-house computer operations was a series of computer programs Monroe developed for U.S. Growers. These interactive programs bring order processing, pallet and separator accounting, inventory control and accounts receivable into an integrated warehouse DP system.

Despite a threefold increase in commodities stored, the warehouse firm has cut its DP budget since the system's acquisition, Monroe said.

The total monthly budget, including personnel, is $4,800, the same as the previous service bureau fee alone. The system is on a lease/pay-out plan which amortizes the equipment over five years, providing follow-on economies.

System Gets Credit For Cutting Inventory

(Continued from Page 27)

process, vendors and accounts payable and receivable.

The company has reduced its inventory by $1 million and at the same time doubled its materials usage, Eytchison said.

This has been accomplished through the use of a materials requirements planning system that allows the company to project all materials by quantity. It tells the firm when materials should be ordered, thereby eliminating the guessing.

Another benefit of the system has been better customer service through timely deliveries, Eytchison said. The priority dispatch system has enabled the company to increase its capacity by about 45%, he noted.

"Before we put in the system, we would release jobs and try to build based on all the components that went into a job.

"But the priority dispatch system schedules each component part to an end product," he said.

This Scotch® data module has two extras built in.

Extra number one for this Scotch brand 948 data module is 3M's exclusive Crashguard® protection, a tough oxide designed to resist headcrash damage, on all disk surfaces.

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3M COMPANY

Mini Interfaces to Moving-Head Disk

BURLINGTON, Mass. – Xylogic OEM Components Group, Inc. has introduced an OEM system based on the Digital Equipment Corp. LSI-11 mincomputer which is interfaced to a moving-head disk.

Designed for small business systems requiring more capacity than a floppy disk, the system utilizes the Phoenix 45 disk controller, a spokesman said.

The unit operates under the RT-11 operating system. It can accommodate up to 20M bytes of disk, four terminals, a line printer and a 28K-word processor, he added.

A Phoenix 145 system with a 5M-byte disk drive, but without the LSI-11 mini or memory, costs $12,650 from the firm at 42 Third Ave., Burlington, Mass. 01803.

Cement Plant Mixes Savings With Process Control System

MISSISSAUGA, Ont. – A minicomputer-based process control system has enabled a cement plant here to save time and money, according to the user.

The St. Lawrence Cement plant began using a process computer in 1972. The purpose at that time was to maintain stable kiln conditions, a spokesman said.

That is still the key function of the plant's Data General Corp. (DG) Nova system, but its role has been expanded into peak power monitoring, kiln bypass system control and limited control of raw grinding, according to the spokesman.

The most significant improvements have been in kiln operations, he noted.

More exacting control by the system has contributed to an annual kiln production increase of 13% and a 5% yearly savings in fuel consumption. More efficient operations have allowed a 2-1/2% increase in kiln utilization, he added.

Kiln Control

The multivariable control system for the kiln uses a building block approach with three interrelated loops for kiln fuel control, kiln speed control and preheater temperature control. These loops in turn depend on dozens of other variables in each section of the kiln.

The fill-in-the-blanks type of control package was written using DG's Fortran IV to let process engineers vary the structure and extent of control functions, the spokesman said.

Continuous changes in conditions make it impossible to operate a kiln with fixed flow or speed settings. With the computer control system, the set points are generated and updated automatically, he said.

The computer calculates new set points using an algorithm based on history and current status of kiln variables, he stated.

The continuing increases in energy costs have strengthened the importance of power peak control in the St. Lawrence system, according to the spokesman.

A maximum monthly demand value is established and entered into the system. The system continuously monitors plant energy consumption and predicts a peak value. If the predicted current peak violates the established demand, an alarm is sounded, he said.

Also, a message is issued informing the operator which piece of equipment must be shut down to stay within the limits. Before starting any equipment, operators can ask the system if that equipment will use sufficient energy to violate the peak.

The system performs other tasks including temperature control for the bypass system, control of cement finish mill separator speeds and monitoring for alarm conditions, he said.

It also provides other displays and information so operators can interpret equipment status. Operators can call up displays or demand printouts of process measurements, set points and alarm conditions.

Operators are also provided with a printout of comparative trends during the previous shift, he noted.

The St. Lawrence system was installed by Interautomation, a Canadian systems engineering firm. In addition to the computer with 32K of main memory, the system includes a cassette drive, character printer, disk storage, CRT display and teletypewriters.

Based on DEC CPUs

Measurex Mini Controls Plastics

CUPERTINO, Calif. – Measurex Corp. has announced a minicomputer-based system for the control of plastic sheet and film extruders and similar processes.

Based on Digital Equipment Corp. CPUs, the Measurex 2000/25 uses a dedicated 16-bit system for each line being controlled, a spokesman said.

The system's control center uses a computer chassis and operator's interactive color CRT which can also be remote-mounted outside the cabinet.

The system includes a terminal, printer/plotter and dual floppy disks. The disk is used for management information system functions and for information transfer, he said.

Measurement and control functions are independent of the data terminal.

The system costs about $125,000 depending on configuration. Add-on systems cost about $90,000. Measurex is at 1 Results Way, Cupertino, Calif. 95014.

GRC Has DEC-Based Micro

HARTFORD, Wis. – General Robotics Corp. (GRC) is offering a microcomputer system based on the Digital Equipment Corp. PDP-11/03 CPU and running under the DEC RSX11/M Real Time Executive.

The system, called the GRC11/03 RSX, includes the PDP-11/03 CPU with hardware multiply, divide and floating point, 20K words of random-access memory, a Unibus port, a CRT, an 80-column printer and a dual double-density floppy disk as well as the RSX11/M software, GRC said.

The system costs $17,000 from the firm at 57 N. Main St., Hartford, Wis. 53027.

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If you're marketing products or services in this field, note that our ad closing is October 8th. For details on advertising, contact your *Computerworld* salesman. Or reserve your space by calling Judy Milford at (617) 965-5800.

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Mini System Places Dealer's Dollars In Right Products at the Right Time

(Continued from Page 30)

"Other systems we looked at didn't allow for a software package that would best suit our needs," Baribault explained.

"For instance, most other equipment would require us to assign our own parts numbers to the various manufacturers' parts numbers. Since we have an inventory of 15,000 parts representing over 60 product lines, we felt the complexity of maintaining two separate numbering systems would make it extremely difficult.

"The Basic/Four equipment enables us to use the manufacturers' designations whether they're numeric or alphanumeric. Our people didn't have to learn a new procedure and our salesmen continue to use material they're familiar with," he said.

'Basic Philosophy'

"From the very beginning, our basic philosophy has been based on the idea that most computer systems are designed initially at the accounting level, then somehow work their way into customer service applications," Baribault explained.

"We felt that by addressing ourselves to the sales cycle and the inventory cycle, we would get the accounting function as a by-product. As distributors, these areas are much more important and much more difficult to deal with, since this is where the majority of our costs are," he added.

The only personnel to take the operator's course offered by the computer supplier were several of the clerical people who handle the basic DP.

Simple Learning Process

"With the small business computers designed the way they are today with simplified programming language very similar to everyday business terminology, the learning process is really quite simple," Baribault concluded.

Supermini Tape Drives Coming

NEWTON, Mass. – Magnetic tape users can expect to see developments that will include supermini tape drives featuring 1/2-in.-tape, automatic threading, speeds up to 125 in./sec and group code recording at 6,250 bit/in., according to Robert N. Tullos of Pertec Computer Corp.

Speaking at the Invitational Computer Conference here recently, Tullos told a group that "at the microcomputer end, tape cassette and cartridge systems are competing with floppy disk drives for the program loading functions."

But, at the other end, "mass store systems using magnetic tape are now being considered for the superminis," he noted.

"These will be smaller equivalents of large mass store systems such as the IBM 3850 and the Ampex Terabit systems" and may use wide 2.7-in.-tape, he said.

"A key consideration for these systems must be a transfer rate and format that emulates disk storage so data can be transferred from the tape store to disk and vice versa without going through the host processor.

"The overall objective is to reduce the need for tape-handling personnel to search libraries when files are needed."

New semiconductor developments cannot affect the mechanical parts of the tape drive, so those costs are not reduced by semiconductor integration, according to Tullos.

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DATA COMMUNICATIONS UPDATE EAST... NEW YORK, OCT. 6-7, 1976

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The Program

OCT. 6 – A.M.: NETWORK PROCESSORS

Popular mainframes and how they stack up for datacomm applications, with a look at how mainframe manufacturers are upgrading their machines' teleprocessing capabilities.

Datacomm software. How the trend to distributed DP and on-line data base systems is affecting data communications software offerings, and what changes users can expect with SNA-type networks.

Communications processors. Users detail their evaluation procedures for selecting communications processors for front-end and message switching applications.

Plus – a rundown on IBM's enhancements to its 3704/5 and the improvements they triggered in competitive front-end processors, as well as the state-of-the-art with the less-volatile message switchers and data concentrators. Also a review of processors and their role in centralized and distributed networks, with an update on networking techniques and protocols.

P.M.: TERMINALS

Terminal evaluation. Users give their individual formulas for appraising on-line interactive devices and data entry/processing terminal systems.

Teleprinters and glass Teletypes. A status report on the latest impact and non-impact machines and their CRT equivalents.

Microprocessors and semiconductor memories. How they are improving IBM 3270-compatible terminals.

Multifunction terminals. An examination of the trend to combine the traditional functions of data entry and remote batch terminals.

Latest vendor moves in intelligent terminals, and how users can best make the intelligence pay.

OCT. 7

A.M.: DATA TRANSMISSION SERVICES

Carriers. Leading users explain their rationale for selecting services from various carriers.

Tariffs. A study of Bell's latest tariffs, including MPL and DDS, with the latest on its switched digital offerings.

Satellites. A review of the services and tariffs of specialized and satellite carriers.

Value-added carriers. A tutorial on packet-switched services with a rundown on tariffs and carrier plans.

International services. A look at how they stack up for data communications in light of recent moves by the FCC and the international record carriers.

P.M.: MODEMS AND MULTIPLEXERS

Evaluations. Users assess modems and multiplexers and trace their trade-offs in making evaluations.

Latest developments with high-speed modems and the trend to intelligent multiplexers.

Post-DAA view of medium- and low-speed modems and the changes users can expect with digital transmission services.

Network diagnostics. Users outline their equipment selection and network management procedures for ensuring minimum system downtime.

Test gear. How portable, easy-to-use devices can help users become better network managers.

Tech control centers and other tools for diagnosing and correcting problems in centralized and distributed networks.

Your UPDATE/EAST Registration Form

Dr William A Saxton Chairman
Data Communications UPDATE
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Please sign me up for Data Communications UPDATE/EAST, October 6 and 7 at The Plaza. Enclosed is my registration fee of $195*.

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Please register the following additional persons from my organization at the reduced rate of $175* each.

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*Fee includes notebook of seminar materials, two luncheons, and morning and afternoon refreshments.

Due to space limitations, registration must be on a first-come-first-served basis.

Speakers announced for UPDATE program

E. F. Severino
Auerbach

P. R. DeVane
Mfrs. Hanover

M. S. Huffman, Jr.
Comms. Mgt. Ctr.

G. Held
Civil Service

G. S. Bernstein
Naval Command

R. J. Kaufman
Damon

Leading datacomm users, consultants, and vendors are scheduled to address attendees at Data Communications UPDATE, sponsored by *DataComm User* magazine, October 6 and 7, 1976 at The Plaza in New York City.

Speakers and subjects to be covered include:

CPU's: Elizabeth F. Severino, Managing Editor, Auerbach Information Management Series. **Datacomm Software:** Ernest E. Keet, President, turnkey systems inc. **Communications Processors:** Gilbert Held, Acting Chief, Teleprocessing, U.S. Civil Service Commission; Clarence G. Marshall, Director of Advanced System Development for Communications Switching, Collins Radio Group/Rockwell International; Richard A. Loveland, Product Manager, Networks and Communications, Digital Equipment Corp.

Terminals: George B. Bernstein, Jr., Operations Research Analyst, U.S. Naval Supply Systems Command; Daniel M. Printz, Marketing Planning Manager, Teletype Corp.; Gerald W. Fleming, Manager, Applications and Development, Data 100 Corp.; Les E. Staples, Product Manager, Data Communications, Datapoint Corp.; Loren Parsons, Product Manager, Applied Digital Data Systems.

Transmission Services: Stan M. Stanley, Administrator, Telecommunications, American Can Co.; Minor S. Huffman, Jr., Executive Vice President, Center for Communications Management, Inc.; Wayne A. Robins, Marketing Director, Data Services, AT&T; Ned Farinholt, Director of Market Services, Data Transmission Co.; Serge Wernikoff, Vice President, Planning, Western Union International; Dick Anderson, Regional Manager, Telenet Communications Corp.

Modems: Robert J. Kaufman, Operation Systems Project Manager, Damon Corp.; Ferrel Peltz, Vice President, Regulatory Planning, Codex Corp.; George R. Grumbles, Vice President, Marketing, Universal Data Systems. **Diagnostics:** Paul R. DeVane, Assistant Manager, Communications Planning and Engineering, Manufacturers Hanover Trust; J. Lightsey Wallace, Assistant Director in Charge of Product Planning and New Product Development, Atlantic Research Corp.; James E. Palmer, President, Spectron Corp.

Dr. William A. Saxton, publisher of *DataComm User* and UPDATE chairman, states that the 2-day briefing "provides an excellent opportunity to catch up on the latest developments in data communications products and services." He also urges datacomm interests to register promptly since space is limited. *(Note: See accompanying advertisement for more details and registration form.)*

Design Procedues Changing

Full Use of Capabilities Cited as Challenge of LSI

By Toni Wiseman
Of the CW Staff

LOS ANGELES – The semiconductor large-scale integration (LSI) technology is producing major changes not only in the cost of computing power, but in the way in which computers are designed and built, attendees at the Western Electronic Show and Convention (Wescon) were told here last week.

"The microprocessor and memory devices now being used are just the beginning of the widespread use of LSI in implementing computer designs," Robert F. Wickham of Vantage Research, Inc. said.

Since projections of the technology indicate the present rate of increase in chip density and size will continue into the foreseeable future, the problem for both device suppliers and users becomes one of how to best utilize the LSI capability, he said.

The LSI technology of today, with more than 100 gate equivalents per chip, has progressed rapidly since the MOS process became a production reality in the 1969-1970 time period, Wickham told a session on "The Next Generation/The LSI Computer System."

"The memory market, pioneered by devices like the Intel 1103, brought the MOS/LSI technology to the computer industry," he said. "The memory and calculator markets provided the vehicle for large-volume LSI manufacture, which was required to perfect processes and circuit design techniques."

As a general-purpose programmable logic device, the microprocessor requires users to examine their problems from a different viewpoint, but the benefits far outweigh the problems, he stated.

CW at
Wescon

Microprocessors and memories, therefore, led the widespread use of NMOS as the primary MOS/LSI technology, he added.

Current MNOS products include 4K-bit chips and 16-bit processor devices, Wickham said, observing chip densities and sizes can be expected to continue to improve at the current rate – a doubling of functions (gates or bits) per chip every two years.

"Late 1976 will see the introduction of 16K [random-access memories (RAM)] using NMOS process and 4K bipolar RAMs implemented using injection injection logic," he said.

And, with the introduction of injection injection logic the bipolar technology becomes quite competitive with MOS for building large circuit functions, he added.

Increases in circuit density and reductions in cost per circuit function similar to those on microprocessors and RAM devices are also occurring with read-only memory (ROM), programmable read-only memory (Prom), and electrically alterable read-only memory (Earom) devices, Wickham said.

Future Units

He predicted the system of the future will integrate all of these device types to obtain the best combination of economics, chip count, performance and reliability for a particular application.

"By 1980, we can expect 65K RAMs, 16-bit processors with on-chip ROM and RAM, electrically alterable 16K ROMs and a host of programmable support devices for practically any processor application," he stated.

(Continued on Page 38)

One-Board System May Cut OEM Cost

By Toni Wiseman
Of the CW Staff

LOS ANGELES – The introduction of the second-generation, single-board computer has given the OEM a powerful price/performance alternative for systems design, according to George Adams, OEM product manager for Intel Corp.

OEM systems designers have, in the past, been hindered in their system implementation efforts because their system volumes were too low to justify full component-based designs, he told attendees at the Western Electronic Show and Convention (Wescon) here last week.

"Previous board-level microprocessors did not provide adequate capability and flexibility without resorting to large multiboard systems," Adams said. "OEMs needed a low-cost, flexible and ready-to-use solution to answer these needs."

The solution, according to Adams, is the single-board computer such as the Intel SBC 80/20, which provides system expansion capability, increased on-board intelligence and peripheral control functions to reduce CPU real-time loading.

Microcomputers have also grown dramatically in volume and performance, he said, citing estimates that by 1980 microprocessor complexity will increase five to 10 times while execution time will triple, all at prices approximating those of today.

"If instruction set efficiency is assumed to show a direct correspondence with chip complexity, microprocessors will perform at levels 15 to 30 times those available today," Adams said.

The Real Question

The question facing OEMs is how to cost-effectively take advantage of these developments, he said.

A number of companies have begun to incorporate the power of microprocessor components into their products, but only through extensive component-level design expenditures, he said.

"Microprocessor chips may be used with dramatic cost effectiveness, but this effectiveness is extremely volume-sensitive," he pointed out.

Thus, for OEMs, the question really becomes one of "How can I take advantage of microcomputers without incurring the time and expense of a long component-based design?" he said.

Micros the Answer

The answer is obviously microcomputers on boards, Adams asserted.

But, he cautioned, while microcomputers on boards may provide an easy way to rapidly fabricate hardware, five other essential ingredients are necessary.

These include low cost, design flexibility and the ability to fit small systems on one board so system packaging hardware is minimized.

In addition, for those larger systems requiring additional memory, I/O and peripheral control, the micros must be supported by a full line of directly compatible system expansion boards and hardware.

(Continued on Page 37)

But May Lose Glamour

Hobbyist Called Growing Market

By a CW Staff Writer

LOS ANGELES – Although the hobby computer market will eventually mature and lose some of its glamour, a direct outgrowth will be the realization of a consumer computer for personal use, Robert F. Wickham of Vantage Research, Inc. said here last week.

In its youthful enthusiasm, the hobby market is helping establish the sales, service, education and distribution channels for small, low-cost computers to be used for educational, home and business purposes, he told a session at the Western Electronic Show and Convention (Wescon).

To serve the needs of the computer hobbyist, a new group of companies has come into existence, offering hardware, software and consumer-oriented marketing, Wickham noted.

"Considering that the LSI microcomputer has only been around for about four years, the hobby computer market has shown spectacular growth," he said.

"By mid-1976, an estimated 8,000 to 10,000 personal or hobby microcomputers were in use or under construction, with annual unit sales into this market expected to be at the rate of 10,000 to 15,000 per year for the next three years," he said, predicting there are about 200,000 to 300,000 potential owners of hobby microcomputers.

Cost is a major factor in this market, where a basic kit sells for $200 to $500 and assembled units retail for $1,000 and up, he added.

"Although the LSI chips keep getting cheaper, the items like power supplies,

(Continued on Page 37)

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In Near Future

Hobby Units Seen Evolving Into Personal Systems

(Continued from Page 35)

cabinets and front-panel hardware are not on such a steep price curve," Wickham noted.

Critical Factor

In addition to price, programming expertise is a critical factor in market growth, Wickham said.

"The availability of Basic for use with the [Intel] 8080 has been a boon to the market," he stated. "A surprisingly large number of people, both technical and nontechnical, have learned Basic in either high school or college classes."

Wickham speculated the ultimate limitation on the market is the user or potential buyer who wonders what he will use the computer for after it is assembled and tested.

In order to perform any practical functions, the computers must have some form of input and output terminals, more memory and perhaps some communications capability, he said.

"This runs the bill for the total system up to the $2,000 to $4,000 area, making it difficult for any but the true hardcore computer enthusiasts to rationalize the cost," he stated.

The consumer microcomputer can be expected to have a self-perpetuating market because one of the major new applications for the kits and systems being developed now is in the education market, Wickhem noted.

In addition to providing a market for hundreds of thousands of additional processors, many of the students will go on to be the hobbyists and experimenters of the future, he said.

"Perhaps the greatest long-term impact of the hobby computer market is to generate the products, sales, distribution and service network necessary for successfully marketing personal computers," he said.

"It may be that a less threatening name such as 'personal computational unit' will be adopted, since the personal computer will bear no resemblance to what we now think of as a computer," he contemplated.

Wickham predicted the system will have to be portable, have a universal high-level problem-solving language and be able to operate on a wide range of low-cost "canned" programs for such things as personal financial modeling, optimizing the times in competitive sporting events or determining the optimum time to sell or trade the user's automobile.

"Systems with true consumer marketability will probably not appear until the early 1980s because of the problem of the human interface," Wickham predicted.

"However, the equipment and techniques being developed for video games and the educational markets will provide many of the required low-cost solutions to the input/output and programming problems," he stated.

System on Board Gives Designer Lower Cost Tool

(Continued from Page 35)

"The fifth major characteristic needed by board-level microcomputers is that of complete software and hardware development support tools geared for OEM systems design," Adams stated.

Increase Capabilities

OEMs must also try to gain further advantage from these low-cost computers as well as to configure them into larger systems with increased capability, he added.

"The first problem is answered through provision for more capability on the single printed circuit board," he said. "This will provide an increase in the intelligence of on-board real-time handling and peripheral control, which reduces CPU loading."

Solution to Another Problem

The problem of larger systems with increased capability is answered through the addition of full multiprocessing control so system resources and tasks may be shared via the system bus, Adams said.

"These performance increases provide dramatic increases in system capability. Additional benefits include enhanced system reliability and the ability to tailor the cost of system intelligence to system requirements in a flexible and modular manner," he said.

"The use of multiple low-cost computers with these capabilities would allow system capability to grow with applications requirements at low initial and low incremental cost," Adams stated. "This avoids processing overkill."

Competition, Technology Factors

Design Costs of Micro-Based Products Seen Falling

By Toni Wiseman
Of the CW Staff

LOS ANGELES – Several trends are emerging to reduce the high cost of developing large-scale integration (LSI) microprocessor-based products, among them microcomputer board sets, Manny R. Lemas of Microcomputer Associates, Inc. said here last week.

The cost reductions reflect the increased availability of microcomputer development and production hardware and software as well as the accelerating sophistication of the micro user, he told an audience at the Western Electronic Show and Convention (Wescon).

"Generally speaking, the trends are seen to be predictable in that they are following the general course of events experienced by the minicomputer evolution of a decade ago," Lemas said.

Among these trends are the decreasing cost of hardware, a move from components to assembled boards, sophisticated development systems and support and a move from Assembly language programming to higher level languages, he explained.

More functions per chip, special function chips and de facto standard support chips are also reducing costs, he said, as are standardized peripheral devices.

"Microprocessor prices have been halved, thirded and quartered," and programmable read-only memories, random-access memories and support chips "have also followed suit," Lemas stated.

The steady drop in prices is attributable mostly to improved semiconductor processing technology and keen competition, he observed. Competition has in fact been so keen that profit margins in many cases have been dangerously trimmed, he said.

"Although this price decrease cannot be expected to continue forever, the fact is that a trend toward more-function-per-chip can be expected to continue, and this should provide an effective decrease in net price per function," Lemas stated.

The availability of low-cost assembled microcomputer boards and board sets has induced many users, particularly low- to medium-volume manufacturers, to buy assembled subsystems instead of components, Lemas said.

Although microcomputer assembled boards are not new to the industry, the semiconductor houses only recently began to supply them, he said. It is a very attractive business for these firms as it represents a market for their complete line of circuits, memory and support chips rather than processors alone.

"It also heralds another trend, that of semiconductor manufacturers moving to boards, board sets, enclosures and eventually to systems," Lemas said.

Using All Capabilities Called Big Challenge Of LSI Technology

(Continued from Page 35)

"The limitations in future products lie not with the semiconductor technology, but with the ability of suppliers and users to evolve standard circuit functions which can take advantage of the economics of high-volume semiconductor production," Wickham said.

Semiconductor devices can now place a significant amount of a computer system on a chip, he noted, but added the chip design is a compromise because of limitations of chip size, power dissipation, packaging, production volume and performance.

"We are already into the stage, however, where the chip design must also take into account the system architecture and the system software," he added..

"For this reason, system design, software and semiconductor chip design must now be done at the same time in an integrated process in order that the most efficient trade-offs in each area may be made," he said.

The primary area of application for LSI devices appears to be in the small to medium-sized general-purpose processors, the 8-bit and 16-bit machines, Wickham stated.

The emphasis on this size machine will continue because of the semiconductor manufacturers' need to achieve high production volume with a minimum of software support while maintaining reasonable average device selling prices, he said.

At the very low end will be application-oriented, one-chip processors priced at less than $5 in large quantities. At the other end, the very large DP and scientific machines will require relatively small numbers of high-performance devices, many of which will be customized or in some way customer-unique, he predicted.

The primary areas of product concentration to date have been the processor and memory devices, he said. The current limitation factor for the small and medium systems is input/output.

Work in this area "should lead to a wide variety of programmable interface/control devices for such things as memory control, communications, encryption of data, error checking and correcting, peripheral control and high-level language translation.

"This will permit 8-bit and 16-bit systems to be lower in cost and adaptable to more applications. These intelligent functional subsystems will be under CPU control and will provide the basis for highly efficient function-oriented multiprocessor systems," he said.

As the problem of I/O functions becomes a more routine matter, processor and memory will have evolved to the point where multiple close-coupled processors may be used for the CPU, marking the beginning of the small task-oriented multiprocessor system where input tasks are allocated to a processor under program control, he stated.

"As hardware prices drop, programming becomes the major problem. Hardware will be used to help solve a large part of the software problem, resulting in the increased use of computers," he said.

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Cost for the seminar, including continental breakfasts and luncheons and all course materials is $300 for the first registrant, and $260 for additional registrants from the same company.
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Led by Saul Stimler, author of *Data Processing Systems: Their performance, evaluation, measurement and improvement*, this two-day seminar will give you performance measurement techniques that are *designed* to save your installation money. As well as system performance at your own installation, topics covered include: criteria for quantifying performance, pencil and paper analysis of a system, benchmarking techniques, realtime, batch, and interactive time sharing systems.
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Peripherals Seen Playing Important Role at CDC

NEW YORK – Control Data Corp.'s recent series of product announcements are an indication of the importance of disk, printer, memory, tape, card and display products in the firm's overall computer business activities, according to Gordon R. Brown, senior vice-president for peripheral products.

"One measure of our total commitment to the computer peripherals industry is the revenue contributed to Control Data's overall computer business," he said.

25% of Computer Business

"This grew to a level of nearly $320 million in 1975. That's more than 25% of the corporation's computer business volume for last year," he noted, adding CDC has now reached a point in its development where its major ongoing programs emphasize concentration of assets and increasing returns rather than across-the-board expansions.

It is important for CDC to concentrate its technology programs and market development in those product areas where it has achieved a leadership role, Brown said.

Cooperation is the key to CDC's current strategy, he asserted.

"Our cooperative programs today involve joint-venture development and manufacturing of nearly all the Control Data peripherals.

"And the majority of these programs have developed from the base of our valued OEM-supplier relationships over the past 15 years with systems manufacturers such as Honeywell, NCR and [International Computers Ltd. (ICL)]," he said.

Advantages of Joint Ventures

Brown noted there are numerous advantages to be found when larger companies join to establish businesses that specialize in selected areas of product development and manufacture.

"This is especially true in the computer peripherals industry where shared development and start-up costs – coupled with a large, assured product base – combine to increase the overall stability of the parents of these joint businesses," he said.

"The cost of entry into new product areas is prohibitively expensive. Unfortunately, we've all seen far too many examples of these expenses in the last few years with the departure from our industry of such firms as [General Electric], RCA, Xerox, Singer and others.

"We see cooperative programs as a means of stabilizing the business costs for those companies still in the industry and enabling all of us to compete from more nearly equal bases," Brown stated.

While cooperative ventures are not easy to get started and require extensive work to achieve the potential benefits, they can be highly successful, as witnessed by Computer Peripherals, Inc. (CPI); the joint NCR/CDC venture, he said.

CPI has further strengthened its position through the addition of ICL as a third partner, he noted.

CPI Products

The first product developments from CPI – Control Data's mass storage facility – were announced at the 1975 National Computer Conference (NCC) and customer deliveries have begun.

A group of OEM horizontal bank printers introduced at this year's NCC represent the first equipment completely conceived and developed by CPI, Brown noted.

In the area of rotating memory equipment, CDC has joined forces with Honeywell in Magnetic Peripherals, Inc. (MPI).

"Separately, it would be very expensive for both Honeywell and us to serve the needs of this very large peripheral market area," Brown said.

"But together, our ability to spread development and start-up costs over a large production base means far greater stability in this vital segment of our business," he stated.

MPI's recently announced "Winchester"-technology mini-module drive, a fixed disk drive called the Falcon and a floppy disk subsystem, along with CPI's band printer family, "represent our growing awareness of the rapid growth potential for highly reliable, moderately priced peripheral products in the minicomputer system marketplace," Brown said.

Contracts

Beehive Medical Electronics, Inc. has signed a $6.1 million, three-year contract to deliver Super Bee 2 and 3 terminals and printers to the U.S. Custom Service.

Univac has received a $36.6 million contract from the Federal Aviation Administration to enhance and expand the Automated Radar Terminal Systems (Arts III) equipment.

Western Union Teleprocessing, Inc. has ordered about 15,000, 150 bit/sec modems from General Datacomm Industries, Inc. for use in its TWX network.

EDP Corp., a subsidiary of Anacomp, Inc., has signed a contract to design and install a financial system for Credivit Financia of Brussels, Belgium, a subsidiary of First National City Bank.

Shugart Associates has added General Electric and Tandbergs Radiofabrikk A/S of Norway to its list of SA800 floppy drive customers.

Informatics, Inc. is continuing to operate the National Aeronautics and Space Administration's Scientific and Technical Information Facility at Baltimore/Washington International Airport under a new one-year contract.

National Data Corp. has signed an extended term contract with Security Pacific National Bank of California to provide credit-card authorization services.

Hudson's Bay Co. has contracted with Datacrown Ltd. to provide processing on its retail store applications and corporate business systems and plans to phase out a regional in-house system.

Mathematica, Inc. was selected to design and implement N.J.'s third instant lottery. The firm will use its Compu-Instant system.

Century Computer Corp. has contracted to buy about $750,000 worth of tape and disk drives from Pertec Corp.

Searle CT Systems has signed a contract valued at over $1 million for Interdata Corp. 256K-byte Model 8/32 computers, which it will install in its computerized tomographic scanning system.

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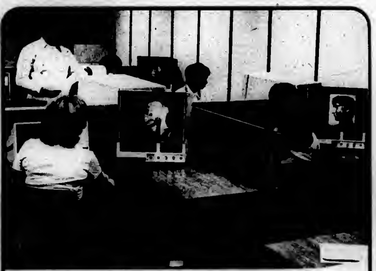

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Commerce Reports DP in India Provides Growing Import Mart

WASHINGTON, D.C. – "Initially, the introduction of computer equipment to the Indian market had a rather checkered history. Now the country appears to have acquired a high level of computer consciousness," according to the U.S. Department of Commerce's recently issued "Market Research Report on Computer Peripheral Equipment" in India.

"In the fifth Fiva-Year Plan [1974-1978], the government of India's Department of Electronics anticipates an investment of $100 million and, during this time, it has placed the country's requirement for computer systems, peripherals and interface electronics, including peripheral controllers, at about $172 million," the Commerce Department said, noting that this figure includes an import content of about $90 million.

One of three reports on India recently issued by the department, the study said the demand for minicomputers will increase from 880 systems in 1974-1978 to 2,665 systems during 1979-1984.

The need for midi computers will jump from 240 to 491 systems in the same time frame, while cost estimates will jump from $172 million to $441.4 million.

The Indian government is creating six regional national computer centers to design software systems, computer network systems and major application programs and study the portability and adaptability of software, the report said.

The government's current import policy grants import permits only for those computers that are essential and cannot be obtained locally, the study noted.

Three Manufacturers

There are three computer systems manufacturers in India, the native Ecil, IBM and International Computers Ltd. (ICL). Ecil assembles CPUs based on imported components and depends on outside sources for peripherals, the Commerce study indicated.

IBM produces card equipment and rebuilds 1401s. Ecil, as of March 1976, had produced 69 systems. ICL is licensed to manufacture 1901As.

The Department of Electronics plans to establish a production capacity of 200 minicomputers a year. The department is reported to be considering granting 10 industrial licenses in conjunction with this plan.

International News

No domestic capability currently exists for such peripherals as high-speed line printers, teletypewriters, disk memories and key-to-tape systems.

The study includes a profile of the domestic market and an end-user analysis as well as a list of major prospective customers and principal trade, industrial and professional associations.

Another report, "Market Research Report on Electronic Components," includes a profile of the end-user market as well as a product analysis and a look at the demand for electronic components in India.

This report also includes a listing of domestic manufacturers and data on market development.

"Market Research Report on Electronic Industry Prodction and Test (EIPT) Equipment" contains similar information for the EIPT market.

The study noted the Indian market for both new and replacement EIPT equipment during fiscal 1975-1976 was estimated at more than $44 million; during 1976-77, nearly $50 million worth of similar equipment will be required by domestic electronics industry end users.

Copies of all three reports are available at $10/copy from the National Technical Information Service, U.S. Department of Commerce, P.O. Box 15553, Springfield, Va. 22151.

Fujitsu Nets M Series Orders

TOKYO – While Amdahl Corp. reportedly has received orders for over 35 of its 470V/6s from U.S. customers, Fujitsu's M series is also doing well, according to *EDP Japan Report* (EDP/JR).

Fujitsu has received 21 orders for the M-190, nine for the M-180 II and 22 for the M-160.

Over 70 of these orders are claimed to be for IBM replacements.

Domestic Vendors' Sales Up, Foreign Makers Slip in Japan

TOKYO – Japanese computer manufacturers reported an upswing in domestic sales during the last quarter of 1975 compared with a marked declina in sales by foreign manufacturers, according to *EDP/Japan Report* (EDP/JR).

Domestic manufacturers reported shipments of 1,031 computers valued at $227.3 million. This represented a 2.4% increase in number and a 34.4% increase in value compared with the third quarter of 1974.

Imports Declined

Foreign makers delivered 626 units valued at $259.4 million, EDP/JR said. This was a decline of 255 units compared with the year-ago period.

"Japanese makers' superior performance during this particular period can be partly derived from the stable nature of the public sector of the market," which includes central and local government, according to EDP/JR.

"In the public sector, there is a rather clear pattern as to order placement and shipment scheduling. Customers tend to place orders during the first half of the fiscal year and makers deliver products during the latter half of the year without fear of cancellation due to changes in economic conditions during that period," EDP/JR reported.

In terms of the installed base of 33,715 units, Japanese makers account for 21,203 while foreign makers claim the remaining 12,512 units.

Itel, Dier Form Joint Venture To Penetrate Pacific Basin Area

SYDNEY, Australia – Dier Computer Corp. and Itel Corp. have entered into a joint venture to penetrate the leasing and specialist computer products markets in Australia and Southeast Asia.

The companies are equal partners in the venture, which will be known as Dier-Itel Computer Corp. Pty. Ltd.

The joint venture will make available to Dier, based here, complex lease financing expertise from Itel, rather than introduce any new sources of financing, according to the UK's *Computer Weekly* newspaper.

In addition, the venture will provide Dier with a convenient and experienced source of software and IBM plug-compatible memory and disk products, *Computer Weekly* said.

Develop Markets

The objectives of Dier-Itel will be to use Itel's financing expertise to "develop markets for products and financial services hitherto undeveloped in the Pacific Basin," according to John B. Dier, managing director of Dier, and John Clark, president of Itel's Computer Products Division.

Dier noted that Itel offered "sophisticated lease structures" which would incorporate advantages for the Australian government investment allowance and tax benefits.

Itel had considered a new relationship with Dier by buying Dier's 50% equity, which is up for sale, but had instead decided the joint venture was cheaper for its objectives in Australia, Clark told *Computer Weekly*.

Dier has offices and sales centers in the Phillipines, New Zealand, Singapore and Hong Kong.

ICL, NCR Get UK Award For '75 Export Achievement

LONDON – International Computers Ltd. (ICL) and NCR Corp. have been awarded the Queen's Award for export achievement in 1976.

Both companies were able to claim record figures, according to *Computer Weekly* newspaper.

ICL's exports now constitute 40% of its production output, valued at $117 million a year.

Dundee, NCR's largest manufacturing plant outside the U.S., is currently exporting 85% of the factory's output and recorded export orders worth $50 million in 1975, according to *Computer Weekly*.

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Off-the-Shelf 8-Bit Micro Advocated As Standard for Military Systems

By a CW Staff Writer

LOS ANGELES – In searching for standardization of microcomputer-based military systems, Ralph Martinez and Reeve Peterson of the Naval Electronics Laboratory Center recommended starting with a commercially available 8-bit CPU.

Technology is not sufficiently advanced to permit standardizing on a 16-bit or slice CPU, they told a session at the recent Western Electronic Show and Convention (Wescon) here.

Any one of several commercially available 8-bit CPUs, militarized and procured to Navy specifications, would be satisfactory for the 8-bit interim standard, they said.

The standard instruction set for the unit would be defined by the 8-bit CPU selected. They did not recommend a custom instruction set tailored to Navy system requirements.

Expensive Alternative

The alternative to selecting an off-the-shelf unit would be to spend two to four years in development time and $2 million to $10 million for a custom 8-bit CPU, they said.

Specifications should standardize on functional modules which can be interconnected to form computer systems, they said.

Hardware standardization is most effective at the highest level of hardware complexity that is common to both distributed architecture, embedded systems and general-purpose computers, they observed.

The hardware and software support functions should be selected by competitive procurement in order to gain the best combination of performance, delivery, multisourcing availability and cost, Martinez and Peterson indicated.

Second Sourcing

Second sourcing should be required for all modules because price and availability tend to be stabilized when more than one source exists, they said.

In addition, they noted, second-source availability for microprocessors implies very high volume device fabrication which is necessary for high reliability.

Hardware and software support systems should be standardized since the microprocessor is used as a device (universal building block) by the engineer and requires sophisticated support hardware to program and debug software/firmware, according to Martinez and Peterson.

HP Consolidating Disk Activities In New Division Based in Boise

CUPERTINO, Calif. – Hewlett-Packard Co. (HP) is consolidating its disk products activities into a Disk Memory Division based in Boise, Idaho.

The new unit will design, manufacture and market the firm's disk memory products and controllers. Until now, responsibility for these products has been assigned to various departments within the Data Systems Division.

In announcing the new divisional status, Paul C. Ely, general manager of the Computer Systems Group, said "disk products are an important and rapidly growing segment of our computer business.

"We are devoting an increasing portion of our R&D resources to assure continued success in this product line," he added.

The new division, part of the firm's Computer Systems Group, officially begins operation Nov. 1. Richard A. Hackborn has been named general manager. He formerly was computer group engineering manager.

The Disk Memory Division will share HP's facility in Boise with the Boise Division, which manufactures line printers and tape drives. Division activities will be shifted from Cupertino to Boise in a series of moves over the next two years, Hackborn said.

Modcomp Lays Off 250 Employees

FORT LAUDERDALE, Fla. – Modular Computer Systems, Inc. (Modcomp) layed off 250 employees in an across-the-board personnel reduction in response to the firm's recent $3.8 million loss for the second quarter ended June 30 [CW, Aug. 30].

The cuts, affecting about 23% of the firm's employees, leave the mini maker with about 850 employees.

About 90 people in manufacturing, as well as others in development, marketing, sales, administration and international operations, were cut from the firm's personnel roster, a spokesman said.

Consulting Firm Set For Health, Hotel DP

BOSTON – Keane Associates, Inc. and Larry Chervenak have agreed to form a corporation, Chervenak, Keane & Co., Inc., which will offer consulting services in operations, DP and related technology in the hotel and health care fields.

The corporation will be equally owned by both parties.

Keane supplies software services and offers facility management services to hospitals and nursing homes.

Chervenak was formerly chairman of Harris, Kerr, Chervenak & Co., which has experience in health care and hotel operations, DP and related technology, according to Keane Corp.

The staff of that company will become part of Chervenak, Keane & Co., Inc., which will be headquartered in New York with regional offices in San Francisco; Kansas City, Mo.; Boston; and San Juan, Puerto Rico.

Md. Firm Specializes In Lease Operations

ROCKVILLE, Md. – Equipment Leasing and Management Co. (Elmco), has been formed to specialize in leasing computers and peripherals to users and provide opportunities to invest in tax-oriented leveraged leases.

Elmco is headed by E. Lee Meadows, former executive vice-president of Computer Leasing Co.

Elmco will also manage computer portfolios for leasing companies and other owners, provide leasing plans for manufacturers and deal in used computer equipment.

The firm's address is P.O. Box 246, Rockville, Md. 20850.

NDC Creates Group For Communications

ATLANTA – National Data Corp. (NDC) has formed the Advanced Systems Group to market, design and manage telecommunications and data communications systems.

In some instances the group will design a communications system, while in others it will design, install and then manage the system for the customer, according to L.C. Whitney, NDC executive vice-president.

Expansions

Ontel Corp. has enlarged its manufacturing facilities with the addition of 60,000 sq ft of plant space in Woodbury, N.Y.

Educational Data Systems, Inc. has moved to a larger, 10,000 sq-ft facility in Irvine, Calif.

Courier Terminal Systems, Inc. will move its headquarters and manufacturing facilities to Tempe, Ariz., where a 152,000 sq-ft plant is being built.

Republic Service Bureau, Inc., a DP firm specializing in the real estate and construction industries, has relocated its facilities to Torrance, Calif.

Braegen Corp. has moved to a 22,000 sq-ft facility in Cupertino, Calif.

Entrex, Inc. has doubled its manufacturing facilities with the acquisition of a new building giving it about 100,000 sq ft of space in Burlington, Mass.

Shugart Associates plans to construct a 60,000 sq-ft facility in Sunnyvale, Calif., to house its administrative, manufacturing, R&D and warehouse functions. Occupancy is scheduled for November.

Basic/Four Corp. plans to occupy a new, 170,000 sq-ft facility in Tustin, Calif. A 110,000 sq-ft building will be for manufacturing and a 60,000 sq-ft facility will house the firm's administration, engineering and research.

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The Operations Support Services Division of Manitoba Data Services is responsible for the provision of new functions and increased productivity for clients, as well as improved performance and additional capacity within the computer complex. To meet the increasing demands in these areas, OSS requires several data processing professionals with extensive experience in a large scale multi CPU environment to function within the following capacities:

PROGRAM MANAGER, PLANS AND CONTROL

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An MS degree plus some rather broad experience with computer system software design would be appropriate.

This is a key position in the overall development of our future P.O.S. system providing high visibility and growth.

We invite you to respond for an early reply.

Robert W. Donovan
Terminal Systems Division - Cambridge
NCR Corporation
Cambridge, Ohio 43725
Phone: (614) 439-0398

NCR

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East: Boston (617/237-3120), New York-New Jersey (201/687-8700), Philadelphia (215/665-1717), Washington, D.C. (703/790-5610).
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South & Southwest: Atlanta (404/634-5127), Dallas (214/638-4080), Fort Worth (817/338-9300), Houston (713/626-8705), New Orleans (504/523-2576).
West Coast: Los Angeles (213/386-5500), Irvine, CA. (714/833-1730), Palo Alto (415/328-7155), San Francisco (415/434-2410).

DIRECTOR OF COMPUTING CENTER

Desirable Qualifications: 1) Strong managerial abilities, oral and writing communication skills, and ability to work with both academic and administrative users; 2) Knowledge and experience in design and development of information systems; 3) A doctorage or commensurate experience would be advantageous; 4) Familiarity with a Burroughs 3500 is desirable.

General: Starting salary range: $18,000 - $20,500 for a twelve-month obligation. Applicant should be available on November 1, 1976. Applications and/or inquiries should be directed, prior to October 4, to Mr. William Mombert, Director of Business Affairs, State University of New York, Agricultural and Technical College, Alfred, New York, 14802.

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OPERATING SYSTEMS PROGRAMMER

Major Philadelphia bank is seeking an addition to its technical support staff which has responsibility for maintaining the software environment for a 370/158. On-Line System (IMS/DB/DC). Responsibilities will include evaluation of hardware and software as well as involvement with CPE.

The successful candidate would have 2-3 years direct experience with OS or VS operating system generation and maintenance. Initial salary to $20,000. Please send resume in confidence to:

A-93, P.O. Box 17182
Phila, Pa. 19105

Equal Opportunity Employer M/F

NEW MEXICO STATE UNIVERSITY

NMSU Computer Center is seeking a Programmer/Analyst II (User Consultant), effective Oct. 11, 1976. Knowledge of APL, FORTRAN, COBOL, PASCAL, SIMSCRIPT, PL/I desired. Work in a progressive environment on a 360/65 with HASP & OS/MVT. Annual Salary to $14,300. Apply to: Mgr./User Services, Box 3AT, NMSU, Las Cruces, New Mexico 88003. NMSU is an Equal Opportunity/Affirmative Action Employer.

COMPUTER PROGRAMMER/ANALYST

Analyze, design, and program a variety of systems for a two year community college. Proficiency in business areas, higher math, and statistics. B.A. Degree plus two years experience preferred. $12,500 plus benefits. Send resume to Samule W. Herbold, Manager, Data Processing Center, Corning Community College, Corning, New York 14830 by Oct. 1, 1976. C.C.C. is an equal opporty/affirmative action employer and adheres to the guidelines of Title IX.

CURRENT OPENINGS PARTIAL LIST

Project Leader (2) To $24K (N.E.) COBOL, 370/OS/VS, CICS, Inventory, Order Entry, etc., Supervisory.
Sr. Prog/Analyst. To $19.5K. (N.E.) ANSI COBOL, BAL, CICS, TOTAL & MRP. OS or DOS.
Prog/Analyst. To $18K (N.E.) ANSI COBOL, OS or DOS with 2+ yrs. consumer goods exp.
OVER 100 OPENINGS NATIONALLY.
All fees, etc., assumed by our client firms. Resume and salary to:
MEEHAN ASSOCIATES, Human Resources Consultants, 3380 Monroe Ave., Rochester, N.Y. 14818.

Systems Consultant

Expanding system's group in Technical Services Dept. of national consulting firm seeks qualified Technical Consultant to do systems and/or application work. Individual should have at least two years of D.P. experience in systems design, thorough knowledge of PL/I, storage management techniques and list processing. Experience with ASSEMBLER language and time-sharing is highly desirable, but not required.

Salary commensurate with experience, plus company paid fringe benefit package, including profit sharing and stock options. Send resume to:

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PROGRAMMER

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Excellent Growth Opportunity in New Dept
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Marathon Oil Company has opportunities for System Software Analysts who have experience on large scale IBM 370 Systems.

We are seeking candidates:

- Who have experience in OS/MVT, VS2R1.7 (SVS), or VS2R2 + (MVS), or any combination thereof.

OR

- Who have experience with real time systems such as INTERCOMM, IMS, or CICS,

AND

- Who are seeking high visibility in a performance-oriented environment

Interested? Pick up the phone NOW and call this number collect 419-424-0030. It will take just a few minutes of your time (we will accept calls from 8 a.m. to 4 p.m. eastern daylight time weekdays and from 1 p.m. to 4 p.m. eastern daylight time on Saturdays and Sundays.)

These positions are located in Marathon's General Office in Findlay, Ohio, and offer a salary commensurate with education and experience and a complete benefits package. (Principals only, no agencies!)

Marathon Oil Company

An Equal Opportunity Employer

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ARE YOU: A SALESMAN with knowledge of 360/370

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Send your resume with salary history in confidence to: Dave Hyland, Greyhound Computer Corporation, 101 Howard St., San Francisco, Calif. 94105.

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(Accounting Systems)

Belden Corporation is a $200 Million Multi Divisional, Multi Manufacturer of wire and cable products with plants located in the Mid Central and Mid Southern States. Our Corporate Computer Center located in our Geneva, Illinois (a west suburb of Chicago) headquarters is planning the installation of a 370/158 this fall running under VS 2 with data base, RJE and interactive communication facilities in place.

We are seeking a Systems Analyst with strong analytical skills in the design and implementation of accounting applications. The applicant must be knowledgeable in accounting applications, work flow and standard journal entries. A knowledge of general ledger, responsibility accounting and cost accounting is desirable.

Salary Range To $20,000 Plus Bonus. Send Resume In Full Confidence To Mr. James L. Brennan.

BELDEN

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SYSTEMS PROGRAMMER

Blue Cross of Western Pennsylvania

has a position open in its Systems Department involving responsibility for providing technical support and consultation to application programming and data processing personnel in such areas as software development and maintenance, and hardware evaluation.

Applicants should have a minimum two year's systems programming experience in an IBM 370 OS-OS/VS environment. Telecommunications experience and a knowledge of IMS/DB-DC or CICS is also helpful, but not required.

Send resume stating work history, educational background, and present salary to:

William C. Cunningham
Personnel Department
Blue Cross
of Western Pennsylvania
One Smithfield Street
Pittsburgh, PA 15222

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SENIOR DATA PROCESSING PROFESSIONALS

Product Managers

DELTAK has several openings for experienced Senior Data Processing Specialists. We develop and market multi-media courses for the data processing industry and serve over 2,000 organizations worldwide. Our courses consist of text, audio, and video materials which are written and produced by DELTAK professionals.

Applicants for these positions should have strong writing, communications, and self-management skills, as well as in-depth knowledge of one or more of the following data processing systems or fields: CICS, IMS, Systems Analysis, OS/VS2 (MVS), JES2 and/or JES3, Distributed Processing, Mini-Computers, Data Bases, Data Communications, Structured Disciplines, or other high technology areas.

A previous background in training is not required; however, creativity, the ability to organize technical information, and strong writing skills are musts.

If you are a highly productive, top performer, DELTAK offers you the challenge to exercise your creativity in an environment which is dedicated to quality work.

If you are qualified, send a complete resume, emphasizing your technical skills and writing experience, to the attention of the Director of Product Development at:

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PROGRAMMER ANALYST

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San Francisco Bay Area

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Please send complete resume and salary requirements to Supervisor of Personnel, GTE SYLVANIA, INCORPORATED, 818 Lexington Ave., Warren, PA 06365.

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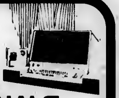

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Melbourne Florida Location

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Senior Systems Analyst

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You will have project responsibility plus formulate and integrate new system concepts. You will assist in determining the economic feasibility of complex projects. A heavy manufacturing background with IMS and previous project leader experience a must. Six years of experience in systems and programming is a requirement.

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Please send your resume in confidence to our Personnel Department at 300 Baker Avenue, Concord, Mass. 01742.

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GenRad

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Current Openings Include:

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(313) 326-7010

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Wausau, WI. based Zimpro, Inc., a rapidly growing engineering contracting firm involved in waste water treatment, has an immediate opening for a manager of its data processing department.

MS level in computer science or equivalent experience with managerial capabilities. Knowledge of project management and engineering/contracting operations. Experience in structuring data base for real time access. Familiarity with mini-computers, preferably PDP 11-70. Experience with BASIC PLUS, COBOL, and RPG II.

Please send resume and salary requirements in strict confidence to:

Mr. Ted Stehly
ZIMPRO, INC.
Rothschild, WI 54474

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Exist with Romac and Associates, personnel consultants. Romac is expanding and seeking partners for offices to be located in Northern New Jersey, in the Southeast, in Pennsylvania, in Ohio, and in other areas. The opportunity to be an independent businessman exists for the well-motivated individual. A record of accomplishment in a data processing, sales environment could provide the experience necessary for success.

Contact H.B. Dunn, Romac & Associates, 125 High St., Boston, MA 02110 (617) 482-7748.

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M.S. or PhD in Electrical Engineering or Computer Science and five years experience in hardware and software design of real-time computer systems.

Language Processor Designers

M.S. or PhD in Computer Science and three years experience in development of programming languages, compilers, translators, assemblers and link editors

Software System Designer

M.S. in Computer Science or Engineering and three years experience in design of software systems for real-time and interactive systems.

Programmers

B.S. in Computer Science, Math, Physics, or Engineering and programming experience with higher order languages such as Fortran, Pascal or PL/I. Both scientific and real-time programmers are required.

Openings for these positions are in Dallas, Texas **U.S. Citizenship Required.**

Send your resume in confidence to:
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As a leading innovator in the telecommunications field, GTE Automatic Electric Laboratories is developing electronic stored program controlled PCM switching systems to meet the needs of the telephone industry for modern TOLL and END OFFICE applications.

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David G. Crowley
Professional Employment
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SYSTEMS PROGRAMMER MARKETING

Headquarters marketing organization of leading terminal equipment manufacturer needs versatile person to research large computer software, actively participate in selling and product development, and trouble-shoot application problems.

Position offers good balance of software, hardware and marketing problems. Function is young and growing.

Technical degree and systems programming experience essential. Data communications experience desirable. Limited travel.

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Data Processing Careers, Inc
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Stemmons Tower West
Dallas, Texas 75207
DETROIT
Electronic Systems Personnel
1705 Fisher Building
Detroit, Michigan 48202
FLORIDA
Data Sciences Personnel, Inc
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15490 N W 7th Avenue
Miami, Florida 33158
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Compass, Inc
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106 Lawyers Building
428 Forbes Avenue
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2530 James Street
Syracuse, New York 13206
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Data Processing Careers, Inc
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2828 East 21st Street
Tulsa, Oklahoma 74114
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An immediate opening exists for an individual with a minimum of 3 years in either mini- or micro-computer basic machine language programming with at least some productive micro-computer programming experience demonstrable. Some telecommunications or computer peripheral device control is desirable. Willingness to do both analysis work and programming on a mixed basis is essential. Must have demonstrated progressive programming accomplishment.

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University Computing Services at the State University of New York at Buffalo has a vacancy for a Mini Computer Maintenance Specialist to maintain mini's and associated peripherals on the SUNY/AB campus. Candidates should have a minimum of five years experience in the maintenance of mini computers. peripherals, and digital interface circuits with at least two years trouble-shooting experience at the component level. Experience with several vendor's equipment is highly desirable. Competitive salary. Excellent fringe benefits. Eligibility for future permanent appointment. Write or call in confidence:

James Whitlock
University Computing Services
4250 Ridge Lea Road
Buffalo, N.Y. 14226
Tel: 716-631-1781

Deadline for Applications: Oct, 20, 1976 *Affirmative Action/ Equal·Opportunity Employer*

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Large Manufacturing company located in the midwest is seeking an experienced computer service engineer to work on Honeywell G435 equipment. Excellent benefits. Send detailed resume including approximate salary requirement to C. W. Ramsey, Manager-Industrial Relations --

WABCO
Construction & Mining Equipment Group
American Standard Inc.
2300 N. E. Adams Street
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D.P. Manager

New position provides excellent opportunity for an experienced manager. Responsibilities will include integrating D.P. department with on-going business, developing new applications, supervising personnel. Minimum 3 years experience in systems analysis required. Experience with System 3/Model 8 or above, RPG II or COBOL programming, and C.C.P. desired. Salary $12 - 16K. Company located in beautiful upstate New York community. Send resume and salary history to:

CW Box 4784
797 Washington St.
Newton, Mass. 02160

COMPUTER PROFESSIONALS

We're seeking experienced computer professionals with extensive backgrounds in computer graphics and data communications/systems programming. These positions are associated with the service and research activities of our Computer Center which is operating with a large CDC equipment. Both positions require a minimum of 5 years experience and good communication, analytical, and entrepreneurial skills.

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You'll be involved with the design and implementation of graphics systems supporting a variety of applications. Experience in computer graphics, interactive systems, and data management is required. Mini/micro computer systems development and engineering background is desirable.

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This position involves development of data communications protocol software in a large front-end processor. Experience or training in data transmission software and operating systems programming is required. Control Data Cyber software experience is desirable.

Battelle
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WANG LABORATORIES, INC.

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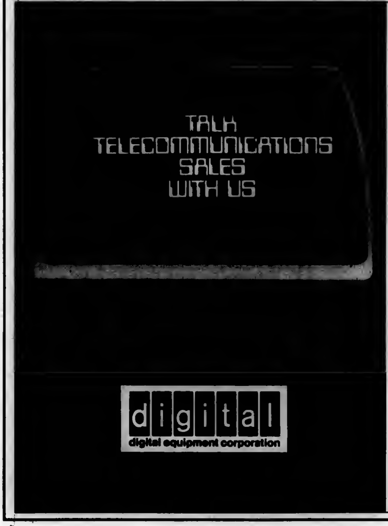

We are Digital Equipment Corporation, the international leader in mini-computer manufacturing and technology. A Fortune 500 Company, Digital is interested in Sales Professionals who have a successful track record in selling computers at the management level. A good understanding of computer hardware/software and communications networks is required.

A profile of the successful candidate is as follows:

- **a scientific or engineering degree**
- **the ability to assume responsibility**
- **the ability to match hardware and software to customer applications within the telecommunications industry**
- **a proven ability to manage, develop and service new and existing accounts**

We currently have openings in our Mid-Atlantic region, from New York State to Florida. If you are interested in further discussing your qualifications, please send your resume to John Ganley, Digital Equipment Corporation, 253 Passaic Ave., Fairfield, N.J. 07006, or to Ron Baulding, Digital Equipment Corporation, 2000 Clearview Ave., N.E., Atlanta, Ga. 30340. Please mark "TELCO" on the envelope and also indicate your area of geographic preference on your resume. We are an equal opportunity employer, m/f.

MANAGER

SYSTEMS PROGRAMMING

Manufacturing-Distributor subsidiary of NYSE co. has an EXCELLENT position for an individual who is self-motivated and has 4 to 6 years in commercial data processing. This position will aid in long range planning, do systems design, programming, and provide guidance to Jr. personnel. Experience in RPG II a plus. Salary range high teens to low twentys. Send your confidential resume to:

Frank Smith

Safelite Industries

P.O. Box 1879
Wichita, Ks 63701

or call 1-800-835-2364

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We are now especially interested in professionals that have two or more years of experience utilizing ANS COBOL and/or PL/1 on large and medium size operating systems. Experience with CICS and/or IMS would be very beneficial.

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SENIOR SYSTEM PROGRAMMERS -GERMANY

The German subsidiary of one of EUROPE'S largest software consulting and data processing companies (GSi) has openings in Germany for individuals with strong

RCA/UNIVAC VMOS and TSOS

experience. Candidates must know system internals and have several years of design and development background. IBM experience considered pluses and preference will be given to those who have knowledge in German. Attractive compensation package and moving expenses are provided. Moderate travel and periodic relocation within Germany is to be expected. Interviews in the USA within one month. Please forward your resume and salary history to:

DATEL Gmbh-DANET

55 Bartningstrasse
D-6100 Darmstadt, Germany

PROGRAMMERS

SYSTEMS PROGRAMMERS

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Average achievement is not acceptable.

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Equal Opportunity Employer M/F

EDP SPECIALISTS

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Comten Net Rises 51% in Half

ST. PAUL, Minn. – Comten, Inc. saw its earnings rise 51% in the first six months of 1976 and 32% in the second quarter.

Second-quarter earnings totaled $313,529 or 12 cents a share compared with $238,288 or 10 cents a share in the year-ago quarter.

Revenues for the quarter rose 40% to $6.5 million compared with $4.6 million in the same quarter last year.

Six-month earnings were $440,636 or 17 cents a share, including a $189,000 tax credit, compared with $292,139 or 12 cents a share in the same period a year ago, when the tax credit was $134,000.

Revenues for the first half of 1976 were up 45% to $11.9 million from $8.2 million last year.

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Comshare Year Earnings Dip Slightly

ANN ARBOR, Mich. – Comshare, Inc.'s earnings for the fourth quarter and year fell behind those of last year.

Earnings for the fourth quarter totaled $194,835 or 11 cents a share compared with $335,401 or 24 cents a share in the year-ago period. The 1975 results, however, included a tax credit of $179,000; the 1976 credit was only $10,000.

Revenues for the quarter were $3.542 million compared with $3.544 million in the comparable 1975 period.

Earnings for the year slipped to $1.2 million or 83 cents a share, including a tax credit of $452,000, compared with year-ago earnings of $1.5 million or $1.10 a share and a tax credit of $744,000.

Revenues for the year rose to $13.8 million compared with $12.3 million in 1975, the result of an approximately $3 million increase in sales of the company's data management and specialty products and services, according to T. Wallace Wrathall, vice-president of finance.

This growth, however, was offset during 1976 by a $1.5 million decline in the use of major applications by the firm's largest 1975 client, he noted.

In the last three months, Comshare annouced three major transactions including the formation of an exclusive joint business relationship with Valuation Systems Corp.; an agreement to acquire the Employee Benefit Services business of Trilog Associates; and an agreement with National Data Corp. to offer cash management services on Comshare's Commander II system and distribute the services throughout the Telegrid network.

Earnings Up 44% In Sycor Quarter

ANN ARBOR, Mich. – Sycor, Inc. reported a 44% rise in its second-quarter earnings while revenues grew 32% to $17.2 million compared with the year-ago period.

Earnings totaled $1.5 million or 45 cents a share compared with $1.4 million or 48 cents a share in the same period last year.

Revenues for the year-ago period were $13.1 million.

For the first six months, earnings reached $2.8 million or 87 cents a share compared with $2.6 million or 92 cents a share in the 1975 period.

Half-year revenues rose to $33.1 million compared with $24.3 million in the comparable year-ago period.

MCI Shows $27 Million Year Loss

WASHINGTON, D.C. – MCI Communications Corp. expects revenues in its second quarter ending Sept. 30 to exceed expenses for the first time in the company's eight-year history.

For the year ended March 31, however, the firm showed a loss of $27.8 million, considerably less than the $39.3 million loss in 1975.

Revenues for the year rose to $28.4 million compared with $6.8 million in 1975.

Loss from operations totaled $12 million compared with $18.7 million last year.

Chairman William G. McGowan estimated the firm's revenues for the second quarter will be $16.7 million compared with $6.4 million in the year-ago period while expenses should be about $16.4 million.

The firm's first-quarter cash flow was a deficit of $400,000 compared with a deficit cash flow of $2.8 million in the same period last year.

Telex First-Quarter Net Slumps

TULSA, Okla. – Telex Corp. reported a slump in both earnings and revenues for the first quarter despite a small profit by its Computer Products Group.

Earnings for the quarter were $1.1 million or 11 cents a share compared with nearly $2 million or 19 cents a share in the year-ago period.

Revenues for the period were down to $24.6 million from $27.5 million in the 1975 quarter.

In a similar trend, computer peripheral equipment lease/rental income dropped to $1.6 million in the first quarter compared with $4.2 million in the 1975 period.

Acquisitions

Technicon Corp. has agreed in principle to acquire T&T Technology, a designer and manufacturer of data acquisition and management systems, for an undisclosed amount of common stock.

Wavetek has acquired Compete, a software and systems engineering firm, through a purchase of assets.

Advanced Computer Techniques Corp. has acquired the Tucson Data Center's processing activities.

Communications Group, Inc. has acquired the Dextel Division of Computer Investors Group, Inc.

Data Communications Corp. has agreed in principle to acquire Interactive Systems Technology for an undisclosed amount.

Itel Corp. has agreed to acquire Autex, Inc. Under the terms of the agreement, 1.5 shares of Itel common stock will be exchanged for each share of Autex common, subject to stock price fluctuation.

Computer Resources, Inc., lessor and manufacturer of computer disk packs, has acquired a majority interest in Constant Data Control, a firm which performs on-site maintenance and refurbishing of disk packs and cartridges.

Itel Corp. has agreed in principle to acquire Computer Dimensions, Inc. Terms of the agreement call for the exchange of one share of Itel common stock for two shares of issued and outstanding Computer Dimensions common.

Computer Data Systems, Inc. has acquired Forlines and Associates, Inc., which will operate as a division.

New Registrations

ITEL CORP., One Embarcadero Center, San Francisco, Calif. 94111, a financial, transportation and data services firm, filed to register 94,760 shares of common, issuable upon the exercising of its warrants exercisable at $6.25 per share and expiring May 1, 1978. No underwriter is involved.

MODULAR COMPUTER SYSTEMS, INC., 1650 West McNab Rd., Fort Lauderdale, Fla. 33309, a digital computer firm, filed to register 70,000 shares of common to be offered in exchange for the outstanding shares of ECS Information Systems, Inc. Fifty thousand shares will be exchanged immediately at the rate of .0814 share for each ECS share; up to an additional 20,000 of such shares, subject to certain conditions, will be exchanged at the rate of .0326 share for each ECS share. No underwriter is involved.

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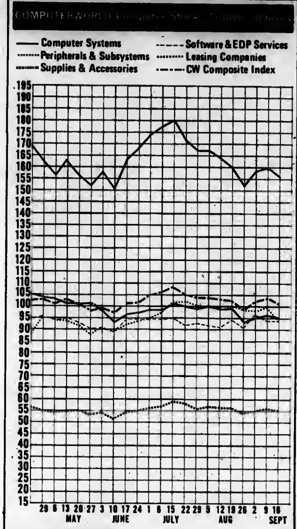

Earnings Reports

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Three Months Ended June 25

	1976	1975
Shr Ernd	$.30	$.26
Revenue	9,712,000	8,020,000
Tex Cred	......	316,000
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9 Mo Shr	1.27	.56
Revenue	29,268,000	23,204,000
Tex Cred	1,208,000	676,000
Eernings	3,304,000	1,410,000

APPLIED DIGITAL DATA SYSTEMS

Three Months Ended Mey 31

	1976	1975
Shr Ernd	$.28	$.20
Revenue	5,412,511	3,880,319
Earnings	1,054,663	762,199
6 Mo Shr	.53	.34
Revenue	10,412,402	7,149,559
Earnings	2,024,100	1,275,105

CONTROL DATA

Three Months Ended June 30

	1976 (000)	e1975 (000)
Shr Ernd	$.67	$.55
Revenue	335,135	299,375
Spec Cred	150	50
Eernings	11,597	9,323
6 Mo Shr	1.25	1.20
Revenue	641,698	581,380
Spec Cred	250	200
Earnings	21,687	20,139

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Three Months Ended June 30

	1976 (000)	e1975 (000)
Shr Ernd	$.86	$.51
Revenue	702,429	680,130
Spec Cred	2,232	1,190
Eernings	19,376	12,685
6 Mo Shr	1.49	.42
Revenue	1,335,984	1,282,289
Spec Cred	3,236	1,190
Eernings	32,929	13,756

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IBM

Three Months Ended June 30

	1976 (000)	1975 (000)
Shr Ernd	$3.94	$3.14
Revenue	4,013,514	3,496,332
Earnings	592,809	468,770
6 Mo Shr	7.57	6.09
Revenue	7,828,331	6,768,330
Earnings	1,137,194	905,993

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COMPUTER SYSTEMS

EXCN		1976 RANGE (1)	CLOSE SEP 15 1976	WEEP NET CHNGE	WEEP PCT CNNGE
N	BURPOUGHS CORP	84-108	91	-2 3/4	-2.9
O	COMPUTER AUTOMATION	10- 19	16	-1 5/8	-7.9
N	CONTROL DATA CORP	18- 27	23 1/4	- 1/2	-2.1
N	OATA GENERAL CORP	40- 60	45	-4 1/2	-9.0
O	DATAPOINT CORP	24- 46	34 3/4	-3 1/4	-8.5
O	OIGITAL COMP CONTPOL	2- 7	5 7/8	+ 1/2	+9.3
N	OIGITAL EQUIPMENT	138-181	159	-9 3/4	-5.7
N	ELECTPONIC ASSOC.	2- 5	2 5/8	0	0.0
A	ELECTPONIC ENGINEER.	7- 16	9 1/4	- 1/8	-1.3
N	FOXBORO	28- 47	44 3/4	- 7/8	-1.9
O	GENERAL AUTOMATION	5- 11	6 1/4	- 1/2	-7.4
O	GPI COMPUTEP CORP	1- 1	3/4	+ 1/8	+20.0
N	HEWLETT-PACKARD CO	85-117	90 7/8	- 5/8	-0.6
N	HONEYWELL INC	34- 56	44 1/2	-1	-2.1
N	IBM	227-280	278 1/4	+1 1/4	+0.4
O	MANAGEMENT ASSIST	1- 3	1 5/8	0	0.0
O	MEMOPEX	18- 33	20 3/4	+ 5/8	+3.1
O	MICRODATA CORP	10- 28	26 1/4	-1 1/8	-4.1
C	MODULAR COMPUTER SYS	4- 14	3 1/2	-1	-22.2
N	NCP	24- 36	35 5/8	- 5/8	-1.7
O	PRIME COMPUTER INC	4- 14	15	- 3/4	-5.4
N	PEPKIN-ELMEP	19- 27	22 3/4	+ 1/8	+0.5
N	RAYTHEON CO	45- 66	62 5/4	+ 3/4	+1.2
N	SPERPY RANO	40- 52	47	-1	-2.0
O	SYCOR INC	19- 31	20 1/4	-1 1/4	-5.8
A	SYSTEMS ENG. LABS	6- 10	6 7/8	- 1/2	-6.7
N	VAPIAN ASSOCIATES	13- 17	13 7/8	- 3/8	-2.6
A	WANG LABS.	11- 20	16 3/4	0	0.0

LEASING COMPANIES

EXCN		1976 RANGE (1)	CLOSE SEP 15 1976	WEEP NET CHNGE	WEEP PCT CNNGE
O	COMDISCO INC	3- 10	7 1/2	- 1/4	-3.2
A	COMMERCE GROUP CORP	2- 3	2	- 1/8	-5.8
A	COMPUTER INVSTRS GRP	1- 3	1 5/8	0	0.0
M	DATRONIC RENTAL	0- 1	7/8	- 1/4	-22.2
A	OCL INC	1- 1	5/8	0	0.0
N	OPF INC	5- 8	7	0	0.0
N	ITEL	6- 15	12 5/4	- 5/8	-4.6
N	LEASCO CORP	6- 19	17	- 1/2	-2.8
O	LEASPAC CORP	0- 1	1/4	0	0.0
O	NPG INC	0- 1	5/8	- 1/8	-25.0
A	PIONEER TEP CORP	6- 9	7 1/4	+ 1/8	+1.7
N	U.S. LEASING	7- 12	9 1/4	- 1/4	-2.6

EXCN: N=NEW YORK; A=AMERICAN; P=PHIL-BALT-WASN
L=NATIONAL; M=MIDWEST; O=OVER-THE-COUNTER
O-T-C PRICES ARE BID PRICES AS OF 3 P.M. OR LAST BID
(1) TO NEAREST DOLLAR

SOFTWARE & EDP SERVICES

EXCN		1976 PANGE (1)	CLOSE SEP 15 1976	WEEK NET CHNGE	WEEP PCT CHNGE
O	ADVANCED COMP TECH	1- 3	1 5/8	- 1/8	-7.1
O	ANACOMP INC	6- 11	6 7/8	+ 3/4	+12.2
A	APPLIED DATA RES.	2- 4	3 1/4	- 1/4	-7.1
N	AUTOMATIC DATA PROC	17- 35	31 1/8	+ 1/8	+0.4
O	COLLMAN AMEPICAN COS	2- 6	2 1/2	- 1/8	-4.7
O	COMPUTEP DIMENSIONS	3- 7	5 1/4	0	0.0
O	COMP ELECTION SYSTMS	5- 9	6 3/4	+ 1/2	+8.0
O	COMPUTEP HORIZONS	1- 2	1 1/2	0	0.0
O	COMPUTEP NETWORK	2- 4	4 3/8	+ 3/4	+20.6
X	COMPUTEP SCIENCES	4- 8	6 1/4	0	0.0
O	COMPUTER TASK GROUP	1- 1	1	0	0.0
O	COMPUTER USAGE	3- 6	3	0	0.0
C	COMSHARE	2- 9	5 1/4	- 1/2	-8.6
O	DATA DIMENSIONS INC	2- 4	2 5/8	- 1/8	-4.5
O	DATATAB	1- 1	1 3/8	0	0.0
N	ELECTRONIC DATA SYS.	12- 18	15 5/8	0	0.0
C	INFONATIONAL INC	1- 1	1/8	0	0.0
O	INSYTE CORP	1- 3	1 3/4	0	0.0
C	IPS COMPUTER MAPPET.	1- 2	1 1/8	0	0.0
O	KEANE ASSOCIATES	2- 4	2 1/4	- 3/8	-14.2
O	KEYDATA CORP	2- 5	1 7/8	0	0.0
C	LOGICON	3- 4	3 3/E	- 1/8	-3.5
A	MANAGEMENT DATA	1- 3	2	0	0.0
A	NATIONAL CSS INC	13- 25	21 1/8	- 1/4	-1.1
A	ON LINE SYSTEMS INC	18- 22	20	- 1/4	-1.2
N	PLANNING PESEAPCH	3- 5	5 5/8	0	0.0
O	PROGRAMMING & SYS	1- 1	3/P	0	0.0
O	PAPIDATA INC	2- 5	2 1/8	- 1/4	-10.5
O	PEYNOLDS & REYNOLO	13- 21	15	-1	-6.2
O	SCIENTIFIC COMPUTERS	1- 1	1	+ 1/8	+14.2
O	TYMSHAPE INC	19- 28	25 1/2	- 5/8	-2.3
A	UPS SYSTEMS	3- 5	3 1/2	+ 1/8	+3.7
X	WYLY CORP	2- 7	1 5/8	0	0.0

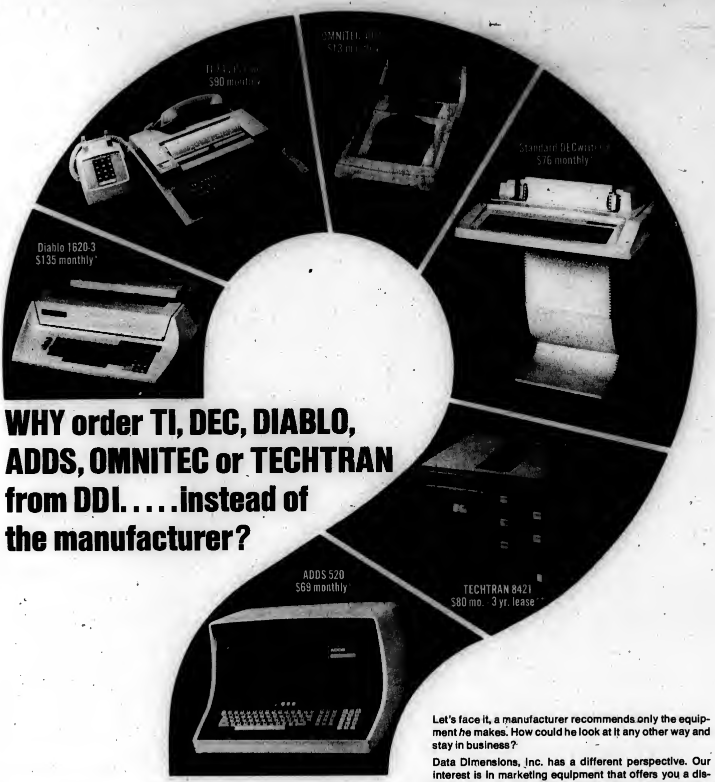
PERIPHERALS & SUBSYSTEMS

EXCN		1976 PANGE (1)	CLOSE SEP 15 1976	WEEK NET CHNGE	WEEP PCT CHNGE
N	ADDRESSOGRAPH-MULT	6- 15	8 7/8	- 1/8	-1.3
O	ADVANCED MEMORY SYS	4- 10	6 3/8	- 1/2	-7.2
N	AMPEP CORP	5- 10	7	- 1/4	-3.4
O	ANDERSON JACOBSON	2- 4	3	+ 1/8	+4.3
C	APPLIED DIG DATA SYS	13- 25	18 3/4	- 1/2	-2.5
O	BEEHIVE MEDICAL ELEC	5- 9	8 3/4	+ 1/8	+1.4
A	BOLT, BERANEP & NEW	7- 11	8	- 1/2	-5.8
N	BUNKEP-RAMO	5- 10	7 7/8	0	0.0
A	CALCOMP	4- 7	4 1/4	- 5/8	-12.8
O	CAMBPIDGE MEMORIES	0- 6	1/2	- 1/8	-20.0
N	CENTRONICS DATA COMP	20- 36	34 1/4	+2 5/8	+8.3
C	COOEP CORP	22- 42	36	-1	-2.7
C	COGNITRONICS	1- 1	7/8	0	0.0
O	COMPUTEP COMMUN.	1- 4	5 5/4	+ 1/2	+9.5
O	COMPUTER CONSOLES	4- 7	5	- 5/4	-13.0
A	COMPUTER EQUIPMENT	1- 3	1 3/4	+ 1/8	+7.6
C	COMPUTEP TPANSCEIVEP	1- 5	7/8	0	0.0
C	COMTEN	4- 9	8 1/4	+ 5/8	+8.1
N	CONRAC CORP	20- 25	21 5/8	- 1/8	-0.5

EXCH		1976 RANGE (1)	CLOSE SEP 15 1976	WEEK NET CHNGE	WEEK PCT CHNGE
O	DATA ACCESS SYSTEMS	1- 4	4 1/4	+ 1/2	+13.3
O	DATA 100	7- 13	8 3/8	- 5/8	-6.9
A	OATA PRODUCTS CORP	5- 15	12 3/8	- 5/8	-4.8
O	OATA TECHNOLOGY	1- 2	1 1/2	- 1/8	-7.6
O	OATUN INC	1- 2	1 3/8	0	0.0
O	OECISION DATA COMPUT	1- 4	1 1/2	- 1/8	-7.6
O	OELTA DATA SYSTEMS	1- 1	1	- 1/4	-20.0
N	ELECTRONIC M & M	1- 4	3 1/8	- 1/2	-13.7
O	FABRI-TEK	1- 1	3/4	- 1/8	-14.2
O	GENERAL COMPUTEP SYS	1- 2	1	0	0.0
N	HAZELTINE CORP	4- 12	8 1/2	- 3/8	-4.2
N	HAPRIS CORP	34- 55	53 1/4	-1 1/8	-2.0
A	INCOTERM CORP	9- 20	11 3/8	+1	+9.6
O	INFOREX INC	3- 7	3 7/8	- 3/8	-8.8
O	INFORMATION INTL INC	10- 18	11 1/2	+ 1/4	+2.2
O	INTEL CORP	59-109	65	+ 1/2	+0.7
A	LUNDY ELECTPONICS	3- 7	3 1/4	0	0.0
O	MSI DATA CORP	3- 7	6	- 1/4	-4.0
A	MILGO ELECTRONICS	15- 21	16 5/8	- 1/8	-0.7
M	MOHAWK DATA SCI	3- 10	6 7/8	- 1/8	-1.7
O	PENRIL CORP	1- 5	2	0	0.0
A	PERTEC CORP	3- 8	6 7/8	- 1/2	-6.7
A	POTTER INSTRUMENT	2- 2	1 5/4	0	0.0
O	PRECISION INST.	5- 10	4	0	0.0
O	QUANTOR CORP	4- 4	4 1/8	0	0.0
O	RECOGNITION EQUIP	6- 11	7 1/2	0	0.0
N	SANDERS ASSOCIATES	6- 11	8 3/4	-0	0.0
O	SCAN DATA	2- 4	1 7/8	- 1/8	-6.2
C	STORAGE TECHNOLOGY	9- 13	11 1/4	- 3/4	-6.2
O	T BAR INC	5- 10	5 7/8	+ 1/8	+2.1
O	TALLY CORP.	4- 6	4 1/4	- 1/8	-2.8
O	TEC INC	3- 6	5 1/4	-1	-16.0
N	TEKTPONIX INC	45- 67	61 1/4	+1 1/2	+2.5
N	TELEP	2- 5	3	0	0.0
O	WANGCO INC	11- 22	21 1/8	0	0.0
O	WILTEK INC	2- 2	2 1/8	+ 1/8	+6.2

SUPPLIES & ACCESSORIES

EXCH		1976 RANGE (1)	CLOSE SEP 15 1976	WEEK NET CHNGE	WEEK PCT CHNGE
O	ADVANCED SYSTEMS INC	1- 4	3 1/4	0	0.0
O	BALTIMORE BUS FORMS	8- 5	2 1/2	- 1/4	-9.0
A	BARRY WRIGHT	6- 10	7 1/2	- 1/4	-3.2
O	CYBEPNATICS INC	1- 1	1/2	0	0.0
A	OATA DOCUMENTS	25- 42	51	+2 1/4	+7.8
C	DUPLEX PRODUCTS INC	13- 24	13 5/8	+ 1/4	+1.8
A	ENNIS BUS. FORMS	6- 8	6 1/4	- 1/8	-1.9
O	GRAHAM MAGNETICS	8- 13	9 1/4	- 1/4	-2.6
C	GRAPHIC CONTROLS	15- 19	15	0	0.0
N	3M COMPANY	55- 65	62 3/4	-1	-1.5
O	MOORE CORP LTD	36- 51	35 3/4	-2 1/2	-6.5
N	NASHUA CORP	11- 18	16 1/2	0	0.0
O	STANDARD REGISTER	15- 19	15 3/4	+ 1/4	+1.6
O	TAB PRODUCTS CO	5- 11	10 1/4	+1 1/4	+13.8
N	UARCO	20- 25	19 7/8	- 1/8	-0.6
A	WABASH MAGNETICS	4- 8	7 1/8	- 1/2	-6.5
N	WALLACE BUS FORMS	19- 25	21	+ 5/4	+5.7



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